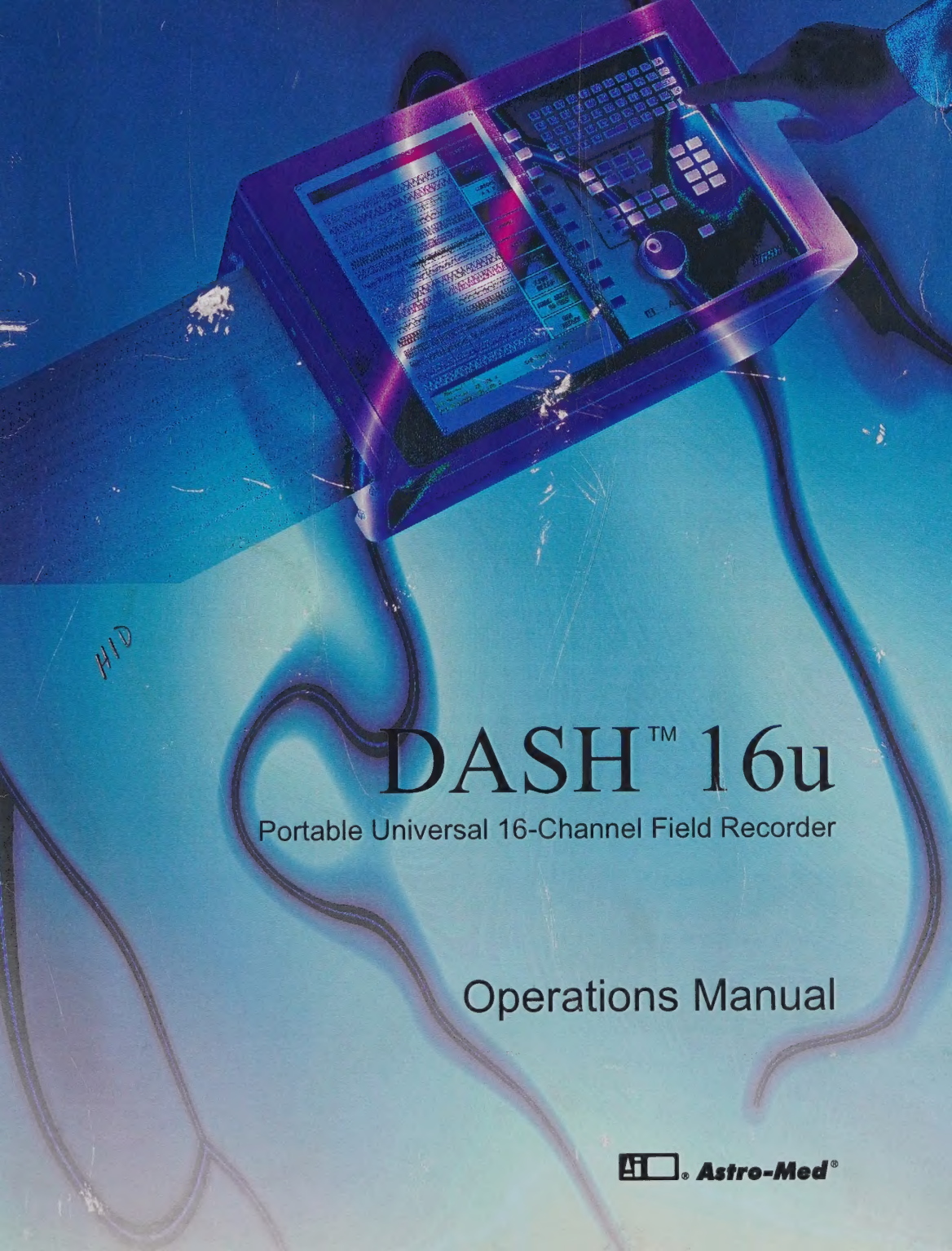

DASH™ 16u

Portable Universal 16-Channel Field Recorder

Operations Manual

Astro-Med®

Dash™ 16u
Operations Manual

Part No. 22834-465

12/00
Firmware V 1.6
Specifications are subject to change without notice.

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600 East Greenwich Avenue
West Warwick RI 02893
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mtgroup@astro-med.com

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Important Information

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FCC Compliance Statement

This device has been tested and complies with Part 15 of the FCC Rules for a Class A digital device. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy; if not installed and used in accordance with the operations manual it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the purchaser will be required to correct the interference at its own expense.

WARNING MODIFICATIONS TO UNIT NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

Canadian Emissions Requirements

This Class A digital apparatus complies with Canadian ICES-003.

Limited Warranty

Astro-Med, Inc. warrants all portions of this equipment against defects in materials or workmanship for a period of one year from the date of original purchase. If you discover a defect, Astro-Med will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement parts will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts become the property of Astro-Med. This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication; or has been modified without the written permission of Astro-Med, Inc.

To obtain warranty services, contact us at 401.828.4000. Astro-Med, Inc. is not responsible for your product if it is lost or damaged in transit. Astro-Med, Inc. makes no warranty, either express or implied, with respect to this product's fitness for a particular purpose.

Disclaimer of Warranty

This software and the accompanying files are sold "as is" and without warranties as to performance or merchantability or any other warranties whether expressed or implied. No warranty of fitness for a particular purpose is offered.

It is good practice to thoroughly test the software with non-critical data before relying on it. It is the customer's responsibility to follow proper file backup procedures in the event of data loss. Astro-Med, Inc. is not responsible for any data loss experienced in operation of this software.

Astro-Med, Inc. does not warranty that the functions contained in the software will meet your requirements or that the operation of the software will be uninterrupted or error-free. The user must assume the entire risk of using the program. Any liability of the seller will be limited exclusively to product replacement or refund of purchase price.

Product Identification

The software provided with your equipment is the most current available.

Record the model number, serial number, and software version installed on your equipment. Any upgrades to resident software should also be noted as they are installed.

IF FOR ANY REASON YOU NEED TO CONTACT ASTRO-MED, INC. REGARDING YOUR PURCHASE, YOU WILL BE ASKED TO REFER TO THIS INFORMATION.

MODEL NUMBER _____

SERIAL NUMBER _____

ORIGINAL SOFTWARE VERSION _____

UPGRADED SOFTWARE VERSION _____ DATE INSTALLED / /

UPGRADED SOFTWARE VERSION _____ DATE INSTALLED / /

UPGRADED SOFTWARE VERSION _____ DATE INSTALLED / /

UPGRADED SOFTWARE VERSION _____ DATE INSTALLED / /

Contact Astro-Med, Inc.

Keep those suggestions coming! We love to hear from you.

To contact the Astro-Med, Inc. Development Group, send us an email at mtgroup@astro-med.com or call 401-828-4000.

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Chapter 1
Before You Get Started

Overview

The Dash 16u is a recording system that combines the features of a high-speed oscilloscope, a real-time chart recorder, and a multi-channel data acquisition system.

Sixteen channels of universal signal conditioning, real-time data display, real-time chart recording, and built-in data acquisition are provided.

Before setting up the recorder for realtime operation, become familiar with the unit and its user interface.

1. **Physical controls.** The front panel is designed to provide clear and fast access to menu commands and other features. Softkeys and hotkeys are provided for quick adjustments to chart speed, display parameters, and channel configuration.

2. **Physical input/output configuration.** Sixteen channels of isolated inputs are provided on the rear panel. Guarded banana jacks provide quick connection to high voltage inputs. Terminal block input connectors provide access to low voltage.

3. **External I/O, data transfer, and remote control access.** The side panel provides Ethernet access and a utility port for external triggering and remote control of some functions. The built-in Zip drive provides offline storage and data transfer capability.

4. **Menu and command navigation.** Configure functions, control waveform display and perform data capture and analysis using the softkeys to the right of the display and the hotkeys on the front panel.

5. **Specifications.** System and input specifications provide operational guidelines and channel configuration parameters.

Front Panel Controls

The front panel is designed to provide clear and fast access to menu commands and other unit features.

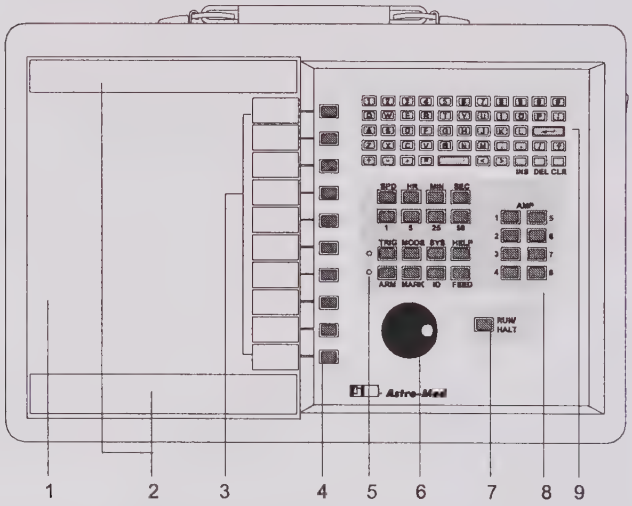


Figure 1, Dash 16u Front Panel

1 **waveform display area**
displays waveforms and grids

2 **upper and lower text areas**
upper: text related to menu items; lower: fields related to menu selections

3 **menu displays**
provide quick access to each control's menus and submenus

4 **menu softkeys**
fast access to menus and submenus on the display

5 **trigger and alarm LEDs**
visual confirmation of unit arming or triggering

6 **encoder wheel**
saves time when making menu selections; when a menu item on the display is highlighted, options related to the item are present in the lower text area and can be modified by turning the wheel

7 **run/halt key**
advances/halts the chart paper

8 **pre-set function hotkeys**
provide quick access to menus, channel information, speed settings, and fast modification of amplifier settings

9 **alphanumeric keypad**
to make text or numeric field entries manually

Encoder Wheel

By turning the wheel left or right, field options are quickly modified.

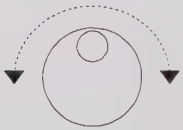


Figure 2, Encoder Wheel

1. If the menu display includes a <<FIELD>> menu label, press the <<FIELD>> softkey repeatedly to highlight the desired field in the lower text area.
2. If the menu display includes a highlighted option, use the encoder wheel to modify it by turning the wheel until the desired option is highlighted.

Once highlighted, an option is selected. Field modifications take effect on the waveform display as soon as they are selected. In some menus, it may be necessary to press the ACCEPT softkey after highlighting options.

Alphanumeric Keypad

When a field in the menu label is highlighted, turning the encoder wheel usually reveals all options. Use the keypad when this is not the case, or if keypad entry is preferred.

1. With the menu label field highlighted, enter text or numbers using the keypad. The entry will appear in the lower text area.

2. Modifications to field options take effect on the waveform display as soon as they are selected. Press Enter to complete your selection.

For information about keypad overlays that include non-English characters, contact Astro-Med, Inc. at 401.828.4000.

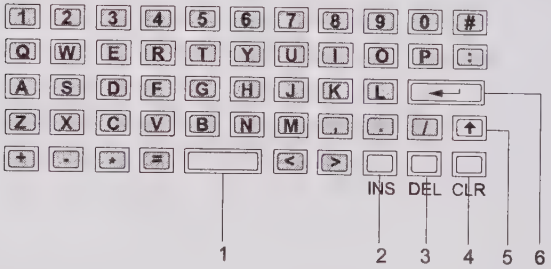


Figure 3, Front Panel Keypad

1 **Spacebar**

2 **Insert**

3 **Delete** clears the rightmost character entered.

4 **Clear** clears the entire entry.

5 **Shift** capitalizes alpha characters.

6 **Enter**

Pre-set Function Hotkeys

Pre-set functions simplify basic operation and real-time recording.

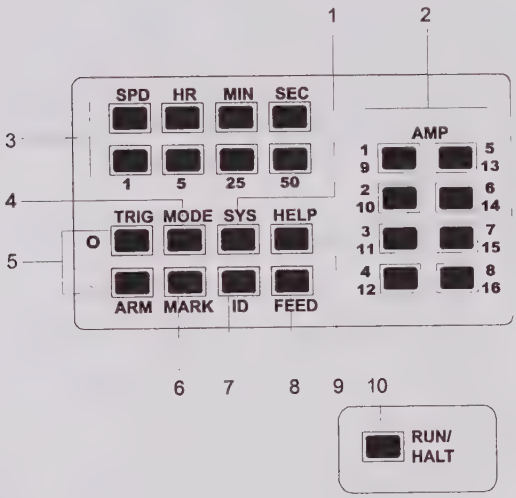


Figure 4, Preset Function Hotkeys

1 **Sys Hotkey.** [SYS] provides quick access to unit setup and system settings menus.

2 **Amp Hotkeys.** [AMP] hotkeys provide quick access to channel information and allow fast modification of amplifier settings.

3 **SPD Hotkeys.** Pre-programmed speed [SPD] keys are provided for making quick and convenient modifications to chart speed.

4 **MODE Hotkey.** [MODE] is provided to simplify data input/output, recording, review, offline analysis, archiving, and exporting.

5 **TRIG and ARM Hotkeys.** Pre-programmed [ARM] and trigger [TRIG] function hotkeys are provided for quick, manual arming or triggering of the system.

6 **MARK Hotkey.** Pressing [MARK] causes the system mark at the top of the chart to activate. The system event marker provides a convenient way to place a mark on the chart that can be used to mark the start or end at some particular change in the test. The mark displayed is formatted according to the Event Style.

7 **ID Hotkey.** [ID] causes the recorder to print the channel number on each waveform.

8 **FEED Hotkey.** [FEED] causes the chart paper to advance. The chart paper feeds through the recorder when the [FEED] key is pressed and stops when the key is released.

9 **HELP Hotkey.** [HELP] provides basic operational information and information regarding recorder settings. This information comes in the form of two reports:

   a. The System Status report provides Settings information (amplifier, general recorder, and trigger), and Summary information (waveform trigger, data capture and review).
   b. The Chart Information report provides a summary of settings for each chart: grid size/position/status, major divisions, minors/majors, pen lift (up/down), event marker position, text buffer (in mm).

10 **Run/Halt.** If printing when the front-panel [RUN/HALT] key is pressed, the chart paper stops. The built-in waveform display shows the base display and indicates that recording activity is halted. If NOT printing when the front-panel [RUN/HALT] key is pressed, printing resumes and the chart paper advances. The built-in waveform display indicates that real-time recording is ongoing.

Rear Panel

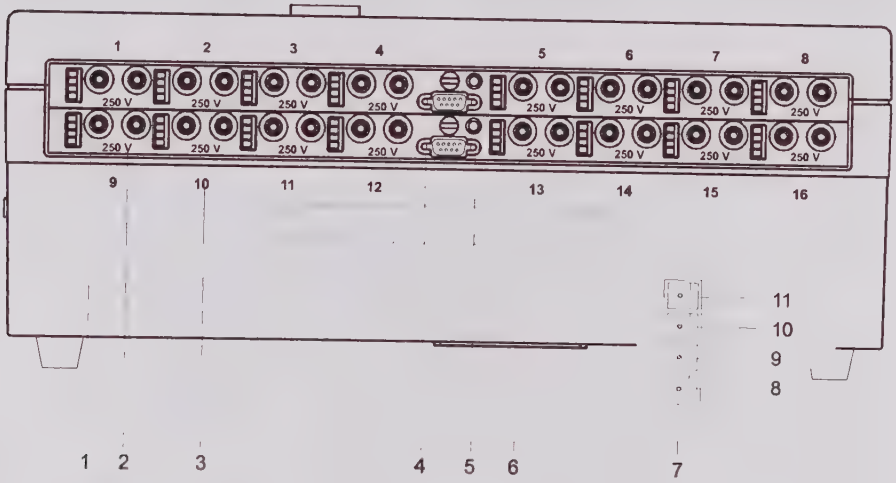


Figure 5, Rear Panel Dash 16u

1	Banana jack input	7	Terminal block input
2	Max voltage indication	8	Pin 4, Ground
3	Channel designation	9	Pin 3, Excitation
4	Event port	10	Pin 2, – Signal Input
5	Temperature thermistor	11	Pin 1, + Signal Input
6	Battery access panel		

Right Side Panel

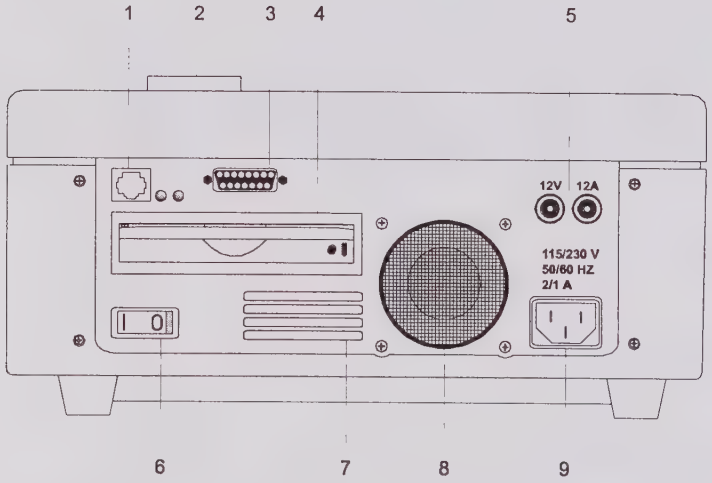


Figure 6, Right Side Panel

1 Ethernet connector

2 Encoder wheel

3 Utility I/O port

4 Zip drive

5 DC power input

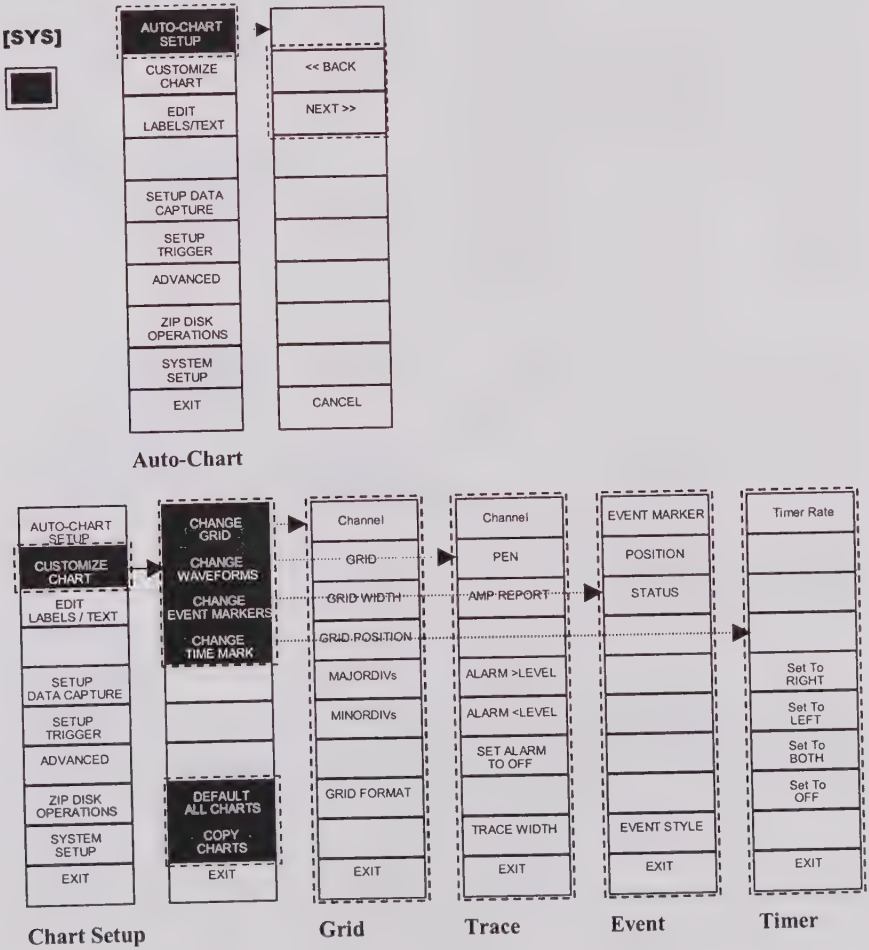
6 Power On/Off

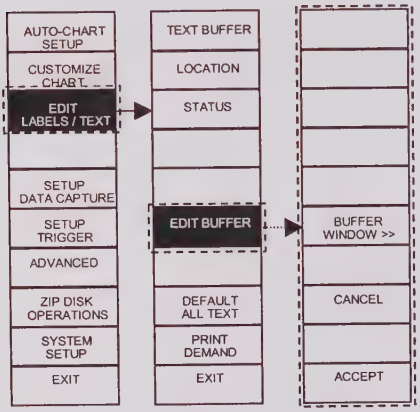
7 Ventilation louvers

8 Ventilation fan

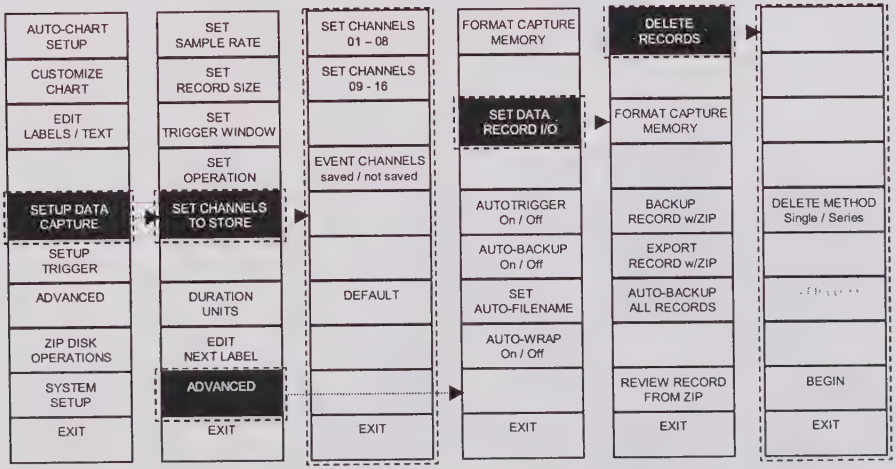
9 AC power input

Quick Reference to Menus & Commands

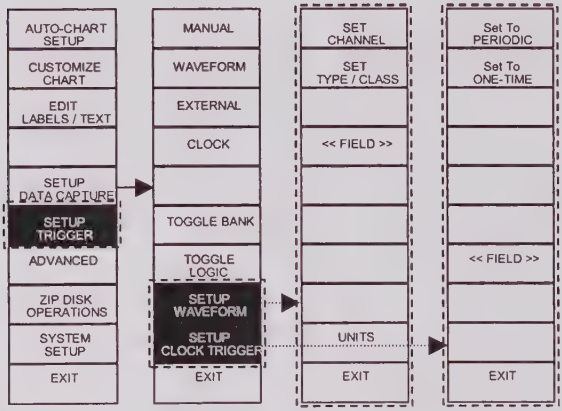




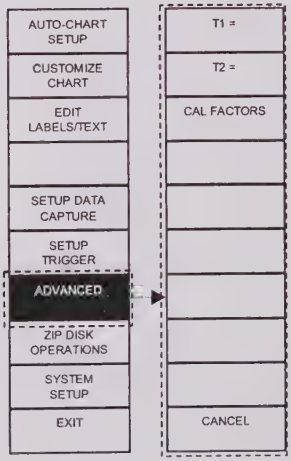
Text Setup **Text Edit**



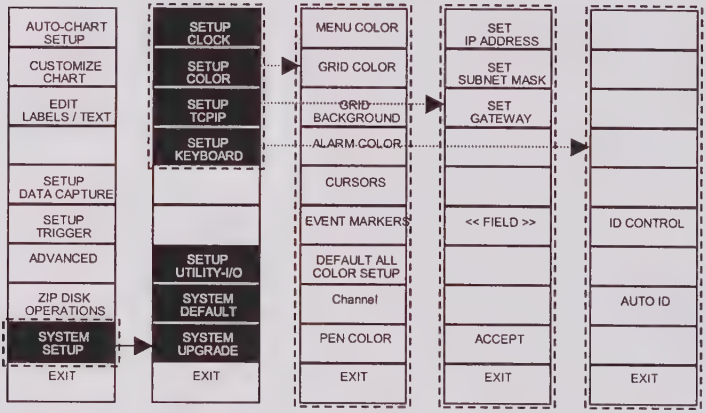
Capture Setup **Channel List** **Capture Setup** **Record I/O**



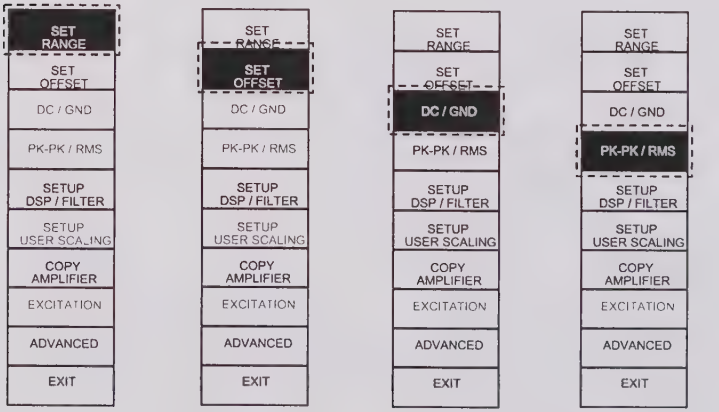
Main Trigger **Waveform Trigger** **Clock Trigger**

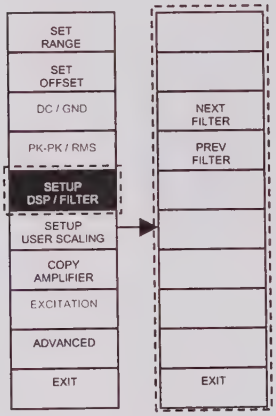


Calibration

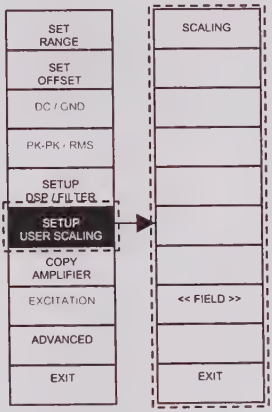

AUTO-CHART SETUP
CUSTOMIZE CHART
EDIT LABELS / TEXT
SETUP DATA CAPTURE
SETUP TRIGGER
ADVANCED
ZIP DISK OPERATIONS
SYSTEM SETUP
EXIT
SETUP CLOCK
SETUP COLOR
SETUP TCPIP
SETUP KEYBOARD
SETUP UTILITY-I/O
SYSTEM DEFAULT
SYSTEM UPGRADE
EXIT
MENU COLOR
GRID COLOR
GRID BACKGROUND
ALARM COLOR
CURSORS
EVENT MARKERS
DEFAULT ALL COLOR SETUP
Channel
PEN COLOR
EXIT
SET IP ADDRESS
SET SUBNET MASK
SET GATEWAY
<< FIELD >>
ACCEPT
EXIT
ID CONTROL
AUTO ID
EXIT
System I/O
Display Setup
Set TCPIP
Keyboard

[AMP]

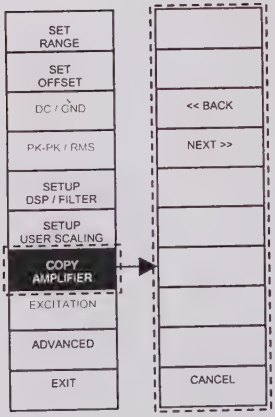

SET RANGE
SET OFFSET
DC / GND
PK-PK / RMS
SETUP DSP / FILTER
SETUP USER SCALING
COPY AMPLIFIER
EXCITATION
ADVANCED
EXIT
Set Range
Set Offset
DC / GND
PK-PK / RMS



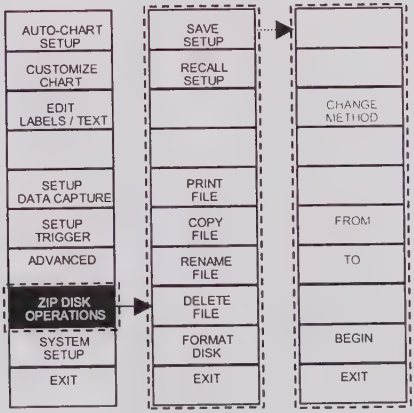
Setup DSP / Filter



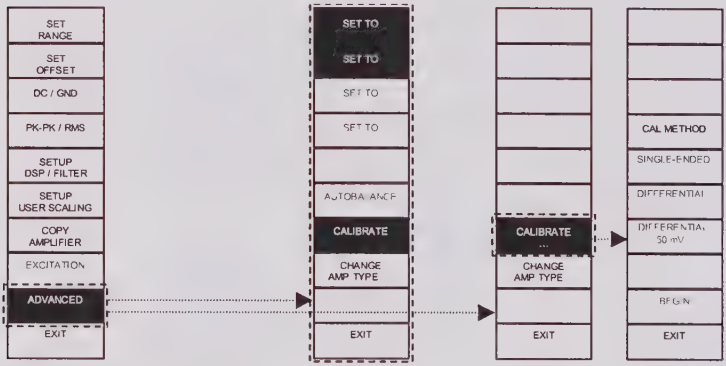
Setup User Scaling



Copy Amplifier



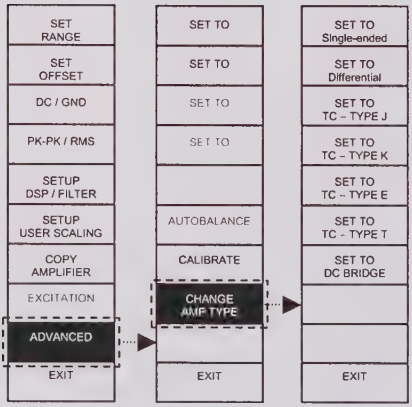
Zip Disk I/O



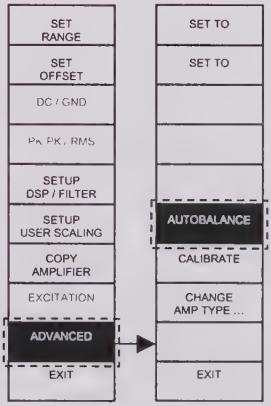
Calibrate Individual Channels or Set Attenuator

Calibrate or Set Attenuator DC Bridge Input Single-ended Input Differential Input

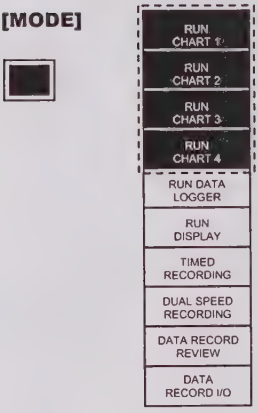
Calibrate Thermocouple Input



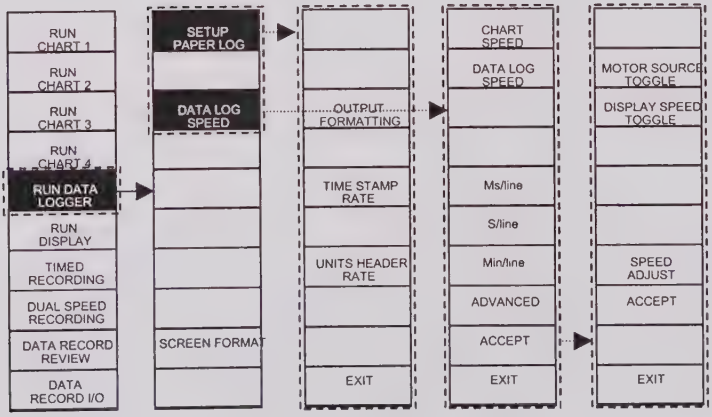
Change Amp Type



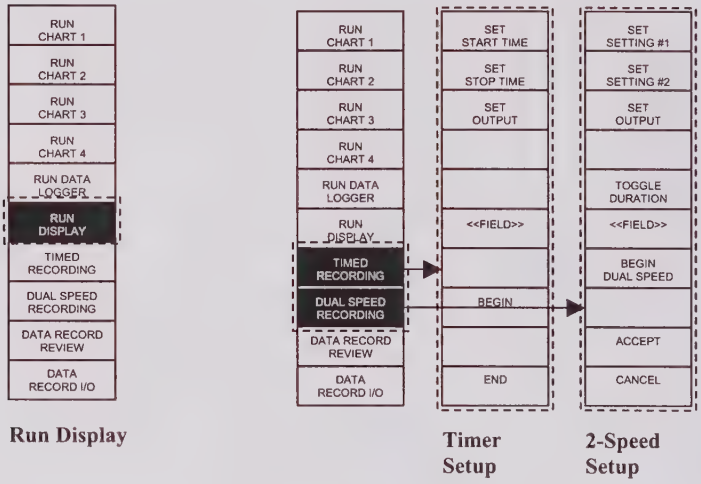
Set Autobalance



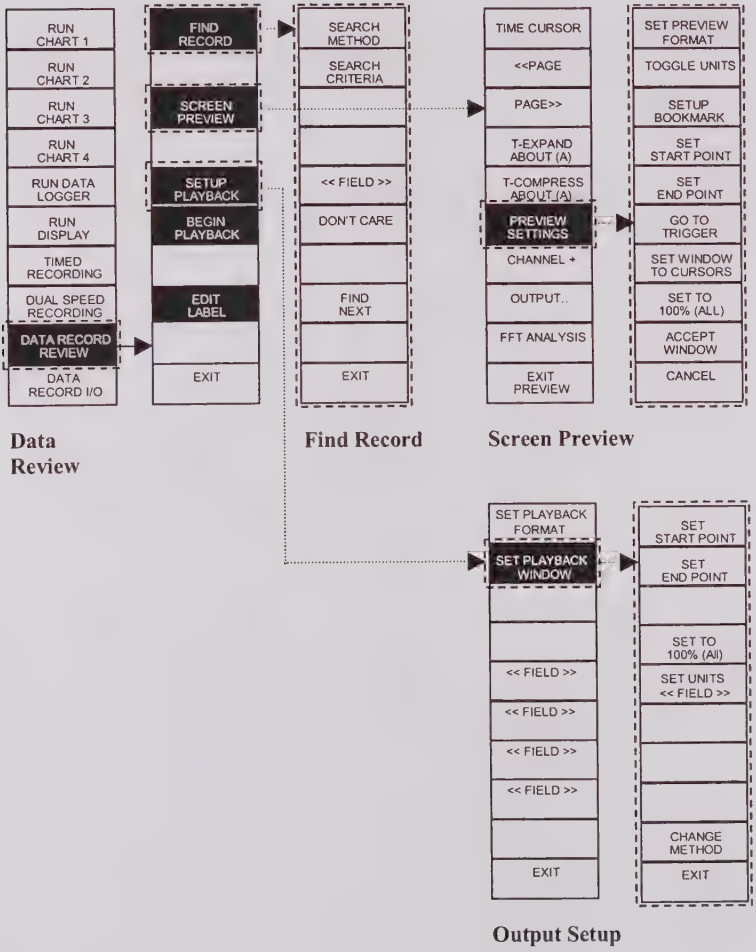
Run Chart



Data Logger **Paper Log Setup** **Set Speed**



Run Display **Timer Setup** **2-Speed Setup**

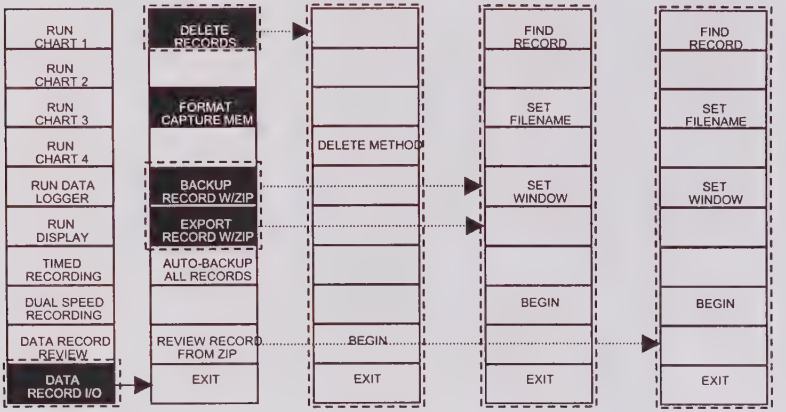


Data Review

Find Record

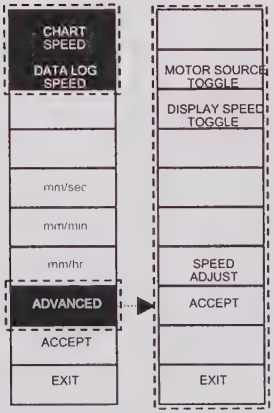
Screen Preview

Output Setup



Record I/O **Delete Records** **Backup or Export Record** **Data Review**

[SPD]



Set Speed

[HELP]

Help Menu

Portable Field Recorder Specifications

Physical

case material .....aluminum

dimensions .....inches: 17" L x 11.2" W x 6.6" H

weight .....< 30 lbs.

display .....active matrix color LCD (TFT); 10.4" (diag); display resolution 640 x 480

Paper Chart

chart size .....8.5" W x 5.5" L (Z-fold, 300 sheets, 137.5 ft)

print resolution .....12 dpm (300 dpi) amplitude and time axes

recording method.....direct thermal

chart speed.....1 mm/hr - 50 mm/sec; accurate ±2% without compensation

external speed control .....TTL pulse to 25 mm/s

remote start/stop.....TTL level or switch closure

amplitude grids .....16 independent grids up to 200 mm wide; grid placement automatic or user-defined

time marking.....tri-state (x1, x10, x100) mark on either chart edge; grid time lines can be synched to time mark; selectable time mark reference rate (0.02 to 1.0 second in 0.2 second increments)

annotation.....auto printing of system log (time, date, speed); 128-character text buffer available on each grid

on-demand buffer .....print in any location across the chart in response to manual or automated I/O

signal conditioner.....auto-annotation using end of grid text buffer

channel ID .....each channel labeled with channel number automatically or manually

trace thickness.....user-adjustable

Power

DC input voltage ..... 11.5 to 18 VDC

AC input voltage..... 85 to 250 VAC at 50 or 60 Hz (auto select)

power consumption..... 100 W typical, 250 W maximum

NOTE **IF OPERATING ON DC POWER, OPERATION AT 14 VDC OR GREATER IS REQUIRED TO FULLY CHARGE THE INTERNAL BATTERY. UPS BATTERY MODE IS UNAVAILABLE WHEN THE BATTERY IS NOT CHARGED.**

Signal Inputs (General)

input types ..... Single-ended voltage, Differential voltage, Bridge, Thermocouple

sample rate ..... 200 kHz

isolation..... all inputs and excitation are isolated to 250 volts from chassis and other channels.

connector .....

banana .....single-ended

screw terminal .....Differential, Thermocouple, Bridge

excitation..... isolated adjustable to 10 V @ 25 mA: accurate within ± 0.1V

filter choices (except where noted)

low pass .....filters out frequencies above specified cutoff; stops from 1 Hz to 10,000 Hz

high pass .....filters out frequencies below specified cutoff; starts from 0.1 Hz to 100 Hz

notch.....50 or 60 Hz center

band pass.....filters out frequencies below the start and above the stop to allow only a selected band of frequencies to pass; starts from 0.1 Hz to 100 Hz , stops from 1 Hz to 10,000 Hz

RMS time constant .....selectable (fast, medium, slow)

waveform testing .....all active waveform channels monitored simultaneously using window or slope/level tests

ADC resolution 14-bit

user scaling .....linear scaling in user-selected units

misc realtime functions .....d/dt, integration

post processing .....frequency spectrum (fast fourier transform)

NOTE **IF RMS, INTEGRATION, OR D/DT IS ENABLED, FILTERS ARE NOT AVAILABLE.**

Voltage Measurements

input types .....

single-ended voltage .....isolated single-ended

differential.....isolated, differential

absolute maximum input.....

single-ended voltage .....±250 Vrms VIN+ to COM

differential.....±40 V LIN+ to LIN-

accuracy (25 °C) .....±0.5% of full scale ± 50 µV

RMS accuracy .....±1.0% of full scale ± 50 µV

bandwidth .....20 kHz (-3 dB)

input coupling .....DC

minimum input impedance.....1 Megohm

IMR at 60 Hz.....>90 dB (shorted inputs to chassis)

CMR at 60 Hz.....>60 dB (differential only)

Intrinsic noise.....

single-ended voltage .....± 0.1% of attenuator setting (filters off)

differential.....± 0.1% of attenuator setting (100 Hz low pass)

baseline drift w/temp ..... 0.1% full scale per °C

CMV (differential only) ..... 40 V referenced to iso common

calibration ..... semi-automated

zero suppression..... yes (limited by maximum span)

user engineering units..... yes

NOTE **ACCURACY SPECIFICATIONS HOLD ONLY OVER SPECIFIED RANGES. MENUS MAY ALLOW OPERATION OUTSIDE THESE RANGES. SEE MEASUREMENT RANGE AND ATTENUATION.**

Thermocouple Measurements

accuracy (25 °C) ..... 0.5% of measurement + 1 °C

cold junction compensation..... ± 1 °C

linearization..... to NIST polynomial

bandwidth ..... 10 Hz (-3 dB)

intrinsic noise ..... 0.5 °C (1 Hz filter)

calibration ..... semi-automated using external reference

user engineering units..... °C or °F

NOTE **ACCURACY SPECIFICATIONS HOLD ONLY OVER SPECIFIED RANGES. MENUS MAY ALLOW OPERATION OUTSIDE THESE RANGES. SEE MEASUREMENT RANGE AND ATTENUATION.**

DC Bridge

Uses Differential Voltage input and excitation. Autobalance is provided.

Data Logger

data logger..... from to 500 milliseconds/line to 999 minutes/line

format..... numerical printout with time stamp

max speed ..... 2 lines per second

Differential Input

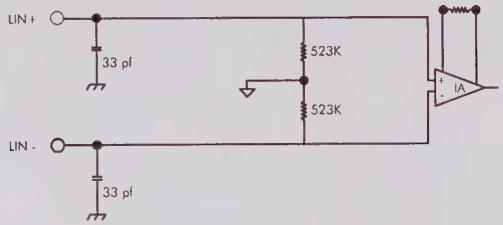


Figure 7, Differential Input

Single-ended Input

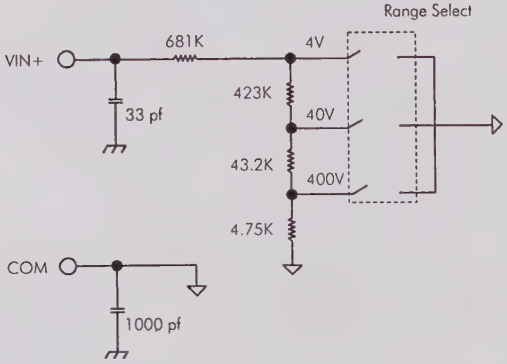


Figure 8, Single-ended Analog Input

Event Inputs

number of inputs.....one per channel

input type.....16 TTL or switch closure

input range.....0 to 5 V

response.....detects if duration > 20 µsec

Measurement Range and Attenuation

TYPE	USER SCALING	MIN. RANGE	MAX. RANGE	SPECIFIED MIN RANGE	SPECIFIED MAX RANGE	RANGE STEP	ABS (MAX OFFSET)	OFFSET STEP
Single-ended Voltage								
attenuation a	yes	0.1 V	4 V	0.4 V	4 V	0.01 V	2.2 V	0.001 V
attenuation b	yes	1 V	40 V	4 V	40 V	0.1 V	22 V	0.01 V
attenuation c	yes	10 V	400 V	40 V	400 V	1 V	220 V	
special	yes	20 V	800 V	80 V	800 V			
Differential Voltage (DV)								
attenuation a	yes	5 mV	50 mV	5 mV	50 mV	1 mV	27.5 mV	0.00001 V
attenuation b	yes	50 mV	500 mV	50 mV	500 mV	10 mV	275 mV	0.0001 V
attenuation c	yes	200 mV	1600 mV	200 mV	1600 mV	10 mV		
DC Bridge (DC)								
attenuation a	yes	5 mV	50 mV	5 mV	50 mV	0.1 mV	22 mV	0.00001 V
attenuation b	yes	50 mV	500 mV	50 mV	500 mV	1 mV	220 mV	0.0001 V
Thermocouple (TC)								
J	F or C	20 °C	800 °C			5 °C	400 °C	1.0 °C
K	F or C	20 °C	1400 °C			5 °C	750 °C	1.0 °C
E	F or C	20 °C	1100 °C			5 °C	750 °C	1.0 °C
T	F or C	20 °C	600 °C			5 °C	300 °C	1.0 °C

Thermocouple (TC) Specified Ranges

J	0 °C	760 °C
K	0 °C	1370 °C
E	-100 °C	750 °C
T	-100 °C	400 °C

Trigger Acquisition

trigger point location .....pre- and post-trigger %, user adjustable

autotrig.....

on .....data is continually captured from the point the system is armed; SETUP TRIGGER settings are ignored

off .....recorder awaits the next trigger after being armed before capturing data; the next trigger will occur according to SETUP TRIGGER settings

window.....all active waveform channels simultaneously

trigger/window .....placement of the trigger within the window (determining the percentages of pre-trigger and post-trigger data captured); any percentage between 0 (beginning) and 100 (end of window)

signal activity .....

slope/level .....can be rising, falling, or either; use to set a signal level and specify whether the trigger will occur if the signal rises above the level, falls below the level, or either. Avoid trying to AND channels when each is set up for slope.

window .....the signal levels (window) within or without which a trigger will occur; window is specified as a high and low percentage of full scale, where the bottom of the grid is 0% and the top of the grid is 100%. You also select whether the trigger is to occur when the signal is inside or outside of this window.

acquisition sources .....

event (wave).....binary combination of active event states; waveform-generated triggers occurring when a signal exceeds or falls below user-defined limits or leaves a pre-defined limit range

manual.....triggers generated when the TRIG hotkey is pressed on the front panel

clock.....periodic triggers generated automatically and continuously at specified time intervals; one-time triggers generated automatically at a specific date and time

external.....externally generated triggers communicated through utility I/O port

Data Capture

number of channels 16

sample rate ..... 0.2 to 200,000 samples/second/channel

external sample rate ..... external TTL sample clock to 50,000 Hz

record size ..... 1 Ks to 4 Ms per module; max record size can be reduced by modifying the maximum MEMORY size permitted; default MEMORY size is FULL memory; memory allocation per channel will be equal

maximum records 128

total capture memory ..... 16 Mb (512 K samples/channel), 8 Mb per 8 channel amplifier module

linking.....up to 4 Ms per module

stacking.....memory can be formatted into blocks so sequential captures an be stacked to minimize time between captures; up to 128 captures

time stamp ..... time and date

header..... information on units, range, sample rates, etc.

events ..... all external event inputs captured with waveforms; all events on one module treated as a single channel for the purposes of data capture

auto arm..... automatic stacking of captures

auto Zip archive .....enable/disable; automatic archive of capture to Zip up to 45 million samples

auto backup .....supported for series of records or for all records

auto chart playback .....all or any section at x1/8 to x8, auto playback supported

review formats .....strip chart, numeric tabular, XY-plot

conversion .....direct conversion to PC/ASCII/Excel formats

edit next label .....each data capture record is automatically numbered in sequence; the label specified carries over to subsequent records

Environmental

operating temperature .....5 °C to 40 °C (40 °F to 105 °F)

non-operating temp .....-15 °C to 60 °C (0 °F to 140 °F)

operating humidity .....10% to 95%, non-condensing

shock/vibration

operating .....no data loss: 10 G (half sine, 11 msec) in any single axis; random vibration from 10 to 200 Hz up to 0.5 G (P-P) in any axis

non-operating .....20 G shock (half sine, 11 msec) in any single axis; random vibration from 5 – 200 Hz up to 1 G (P-P) in any axis

Miscellaneous

LED indicators .....trigger, armed, battery/power

real-time clock .....battery-backed time and date

built-in help/reports .....general, system status, chart information

language support.....English, French, German

text printing .....ASCII files from Zip disk

PC Connection

Ethernet ..... 10 Mbps CSMA/CD, 10 Base T

location .....right panel

protocol.....TCP/IP

Event Port

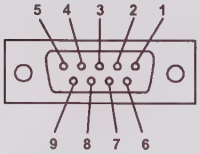


Figure 9, 9-pin Female Event Port

event port..... a TTL or switch closure connection

location ..... rear panel

Pin 1 through 8 ..... correspond to Events 1 through 8

Pin 9..... ground

Utility I/O Port

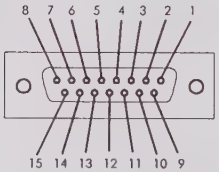


Figure 10, 15-pin Utility I/O Port

function ..... connections for start/stop, remote, etc.

location ..... right panel

Pin 1 ..... External Trigger Input. A falling edge or switch closure on this line causes an external trigger to be recognized if external trigger is enabled.

Pins 2 and 3..... reserved

Pin 4 ..... reserved

Pin 5 ..... External ARM. A low logic level or a switch closure on this pin for at least 100 ms will cause a data capture to be armed, provided there is storage available for it.

Pin 6 ..... Remote Keypad Lockout. A logic level low or switch closure on this input will lock the keypad.

Pin 7 ..... External Abort Input. Active low. A transition to a TTL low that remains low for less than 100 ms will cause any current data captures to be aborted.

Pin 8 ..... External Mark Input. A low logic level or switch closure on this pin for at least 100 ms will cause the system mark to be printed on the running chart.

Pin 9 ..... External Trigger Output. This line pulses low in response to a trigger. This line can be connected to another Dash 16u's external trigger input directly to cause it to trigger in response to the same event.

Pin 10 ..... External Motor Clock. 300 Hz – 25 mm/s max.

Pin 11 ..... Remote Stop. A logic level low or switch closure on this input will remotely stop the chart.

Pin 12 ..... Ground Pin.

Pin 13 ..... Programmable Input. Pin 13 is programmable and can be used for ODB (on-demand buffer) print or remote ID. A low logic level or switch closure on this pin for at least 100 ms will cause the on-demand buffer to be printed, provided the chart is running or the signal ID function is active.

Pin 14 ..... Fused 5V Output. Has 5 volts on it through a 100 ohm current limiting resistor.

Pin 15..... External Sample Rate Input. This pin allows a data capture to be performed referenced to the 40% to 60% duty cycle clock input on this pin. The maximum rate of input is 50 kHz.

Fast Fourier Transform (FFT)

Y-T REVIEW COMPRESSION	LG POWER-OF-2 IN COMPRESSION (1)	EXTRA AVERAGING	NO. POINTS AVERAGED	FFT INPUT SIZE
1	1	1	1	256
2	2	1	1	512
4	4	1	1	1024
8	8	1	1	2048
16	8 (16 actual)	2	1	2048
Bin.choices>16	MaxFFTsize/K=8	Comp/16	(N/2048)	2048
32	8 (32 actual)	4	1 * 4 = 4	2048

Figure 11, FFT Transformation Process Summary

output formats..... linear magnitude plot (Engneering Units)
log. magnitude plot (dB)
magnitude squared

number of channels ..... any one channel

input data ..... real input data from a captured record

input window selection ..... three cursor-based methods to fit FFT tests

FFTsize..... Field is not always selectable. When selectable, represents the size of the FFT process and numer of points (power-of-2) used in the process.

minimum FFTsize.....256

nominal FFTsize.....1024

maximum FFTsize.....2048

FFT window ..... Should be completely visible on-screen unless N-Size/Referenced Operation is performed. FFT window is a summary of the amount of raw time or samples used in the FFT process. It will reflect actual amount used unless:

Cursor(s) are outside the data area displayed on screen, or not enough data remains in the record. If not enough data remains in the record, a smaller amount may be used and will be interpolated by the FFT. As needed averaging will occur on raw data.

window types ..... rectangle, triangle, hamming

FFT results ..... shown on display

cursor measurement..... on-screen

hardcopy results ..... yes

algorithm..... power-of-2 DFT

FFT averaging ..... Indicates the input averaging that will take place based on window selection modes and Y-T compression then in effect. Field will indicate 'auto' if averaging will be determined by the FFT process. Useful when a signal is known to be well over-sampled in relationship to the frequencies being captured; allows more data window to be compressed into FFT sizes.

Averaging can be minimized by controlling compression or the factors that dictate what compression is used. X-axis (frequency) labeling will impact compression usage. Input data averaging techniques, used as required, will cause a direct impact on FFT results. Since multiple data points with a time between samples of (Δt) will be combined by averaging – yielding a larger (Δt). The result is similar to under-sampling during data capture. The ability to resolve frequencies degrades accordingly.

Data Interpolation..... Used to fit the FFT algorithm in use. Use input data interpolation after up-front input averaging. Input data interpolation allows a selected window, particularly one created with variable cursors to be input into the FFT to prevent leakage. The data set (smaller than a power-of-2) is replaced with a new data set with a new adjusted time base. This allows data to begin and end at the same level.

Removing these discontinuities does not eliminate leakage but does help reduce it. Interpolation used is linear. In many cases such as FIXED END POINT and complete data set under cursors, there is no interpolation required.

FFT Transform Operation

Fixed End Point .....

function.....cursor(s) represent a fixed window of points to be used in the FFT; compression factor in use at the time and the fixed cursor positions determine FFTSize and the degree of up-front averaging that may be performed upon the original input signal, as-needed.

FFTSize.....effectively chosen to also yield an integer averaging factor

fixed cursor window.....K=256 display pixels

windowing support.....yes

averaging.....low, binary compression factors are conducive to an FFT without averaging up to a size of MaxFFTSize (2048 points) Using binary Y-T compression causes FFT to yield minimal input averaging effects. For compressions where largest power-of-2 correlates to exceeding MaxFFTSize, up front averaging is performed.

interpolation..... used as-needed to fit algorithm to N power if there is not enough data selected (present under cursors)

Variable End-Point.....

function ..... Variable cursor movement supported to allow the user to closely "slice" off the input data for FFT transform. Variable end point FFT reduces leakage without the need to use a windowing process on raw data – or self-windowing. This is done automatically and more accurately than can be done with FIXED-END POINT mode. Similar to FIXED-END POINT mode, the compression, as well as cursor placement, will play a part in the chosen FFT window size.
Using larger compression and cursor differences results in multiple acquired points in each displayed point making precise end point placement more difficult. In cases where compression and averaging is to be more closely controlled, consider N-SIZE/REFERENCED FFT operation.

interpolation..... If a window selection is short of a power-of-2 specification, the recorder will interpolate the signal to fit the algorithm in use as-needed.
Interpolation is used as-needed to fit algorithm to N power as not enough data selected (present) under cursors. This typically will only be by a factor of less than 2 and will require minimal additional processing time.

averaging ..... As the number of data points specified by the compression and cursor difference exceeds maximum FFT size, further input averaging will be used.

N-Size/Referenced.....

function.....To closely control the FFTSize and specify a starting reference use N-SIZE/REFERENCED FFT operation.

The input waveform need not be completely viewed on the screen. The data included in the FFT will be based on the cursor, the size selected, and compression factor applied.

averaging.....The compression factor in use will be used and directly represents the amount of averaging performed. To disable averaging and reduce raw data input selection to one variable instead of two, set the compression to x1 and find the reference list. Then, return to FFT SETUP, specify FFT WINDOW SIZE, and perform FFT.

FFTsize .....The size of the FFT is specified explicitly and a cursor is placed over the (start) reference point, which must be on the screen. Remaining data used to fit the specified window may or may not be visible on the screen. 256 = MaxFFTsize.

interpolation.....Used as-needed to fit the algorithm to N power as not enough data may be selected (present) after reference. This is usually due to being close to the end of the record.

FFT Axis Labeling

Power Spectrum Amplitude units (Y-Axis)

Magnitude Plot .....units defaults to 0-RANGE (full scale) for measurement

Log magnitude (dB) .....shows decibels and is a result of the following equation: dB = 20* log (Magnitude/Range) The log magnitude

is set to (minimum) dB reading if the magnitude result of the FFT is not greater than 0.11% of full scale. This helps avoid noisy floor and pk/pk noise implications which occur on other output presentations. This limits dB output to –59 dB rather than –71 dB theoretical limit. This dB limit can be bypassed if Y-autoscale is on and will provide full dB range.

Range ..... The full scale range from 'captured' input signal and constitutes the reference for the ratio. This is the reason for normal negative results since comparing versus 'largest' in ratio. The magnitude from each bin point is the top number of ratio.

Y Autoscale Feature ..... If enabled, causes output Y-axis scaling to be adjusted so the plot will utilize the maximum amplitude points to plot size. The magnitude plot handles this by enabling or disabling full dB range presentation.

X-Axis scaling ..... The X-axis is the frequency axis. Some post FFT manipulation may be performed in order to zoom or magnify the results of an FFT. This is useful for FFts which have more resolution or bins than display pixels for the output plot. Page or pan through the available output plots to view desired information.

FFT Windowing

	MAJOR LOBE HEIGHT RELATIVE TO RECTANGLE	HIGHEST SIDELOBE (Ref to Major)	FREQUENCY RESOLUTION	USES
Rectangle	T	-13 dB	Good	Self-Windowing
Triangle	0.5 T	-27 dB	Fair	General Purpose
Hamming	0/54 T	-41 dB	Fair	General Purpose

Figure 12, FFT Window Summary

FFT Data Averaging

Y-T REVIEW COMPRESSION	LG POWER-OF-2 IN COMPRESSION (1)	EXTRA AVERAGING	NO. POINTS PRIOR TO INTERPOLATION	FFT INPUT SIZE
1	1	1	237	256
2	2	1	474	512
4	4	1	948	1024
8	8	1	1896	2048
16	8 (16 actual)	1	3792 (237*16)	2048
Bin.choices>16	MaxFFTsize/K=8	(N/2048)		2048
32	16 (32 actual)	1 * 4 = 4	3792	2048
Odd factors	na/	=compression	237	256

Figure 13, FFT Interpolation Process Summary

Chapter 2
Set Up for Real-time Operation

Before Real-time Recording

1. **Verify Input Line Voltage.** Before connecting your recorder to any outlet, verify that the input line voltage is within power specifications for the recorder. The appropriate input voltage is selected automatically and requires no adjustment once a power line is connected.

2. **Specify System Setup.** If necessary, set the system clock, select waveform colors, configure the utility I/O and trigger I/O, setup triggers, verify the accuracy of internal precision voltage references, and upgrade system software before configuring input channels.

3. **Select and Configure Input Channels.** Physically connect inputs. Select input types from available types, select range and offset settings for channels, and set attenuation.

4. **Calibrate Input Channels.** Both manual calibration of individual channels and calibration using a module supplied by Astro-Med, Inc. are supported.

After setting up the recorder, realtime operation can begin.

System Setup Functions

Setup Clock

The SETUP CLOCK function is used to set the system date and time.

Date is expressed as day, month, year (i.e., 01 FEB 97). Time is expressed as hour, minute, second (i.e., 23:05:03) within a 24-hour day (i.e. 01:00:00 is 1 a.m.; 12:00:00 is noon; 24:00:00 is midnight).

[SYS]

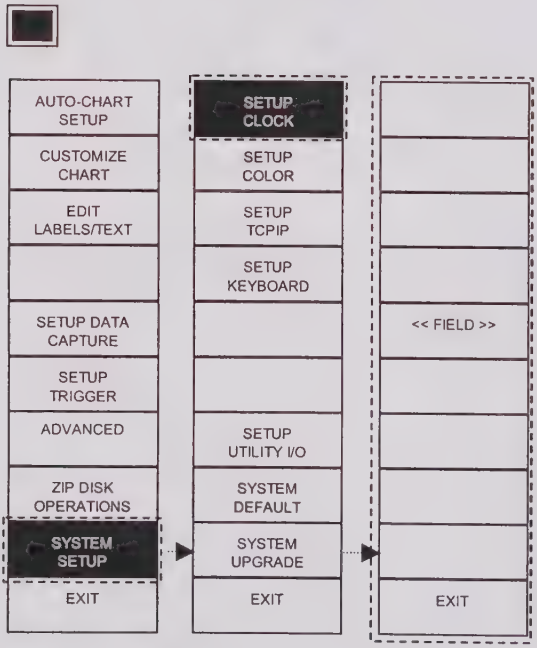


Figure 14, Set Clock

TO SET THE SYSTEM DATE AND TIME:

1. Press the [SYS] hotkey, then the SYSTEM SETUP and SETUP CLOCK softkeys.

2. Use the <<FIELD>> softkey and the encoder wheel to make changes.

Setup Color

The SETUP COLOR function is used to make changes to display colors. The use of color in the waveform display area can significantly improve visibility of important data.

[SYS]

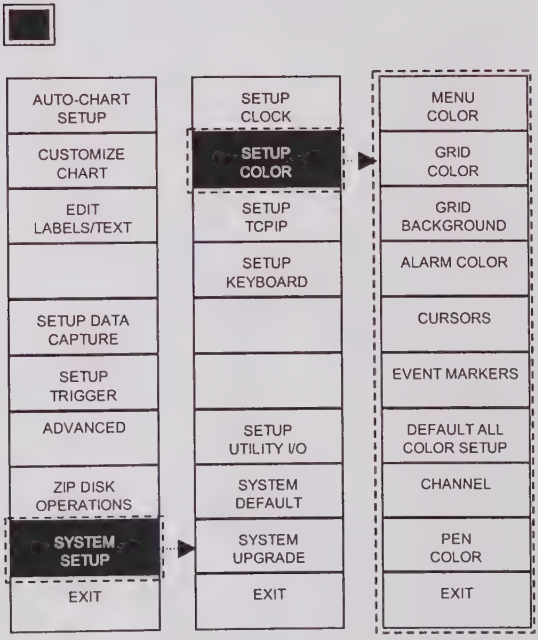


Figure 15, Display Setup

TO MODIFY DISPLAY COLORS:

1. Press the [SYS] hotkey, then the SYSTEM SETUP and SETUP COLOR softkeys.

2. Select from the display options available using the softkeys. Turn the encoder wheel to modify colors.

   A different color for the portion of the waveform in alarm is recommended to provide a clear view of alarm readout.

   Menu text is fixed as white to provide a stable contrast to the menu display region.

TO RESTORE ALL COLORS TO FACTORY DEFAULTS:

1. Press the DEFAULT ALL COLOR SETUP softkey.

COLORS CAN BE SPECIFIED FOR:

- menu background (default blue)
- grid lines (default white)
- grid background (default black)
- alarms (default red)
- cursors (default yellow)
- event markers (default white)
- pen (trace), (default assorted)

Setup TCP/IP

The SETUP TCPIP command is used to setup the IP address, IP subnet mask, and IP default gateway.

[SYS]

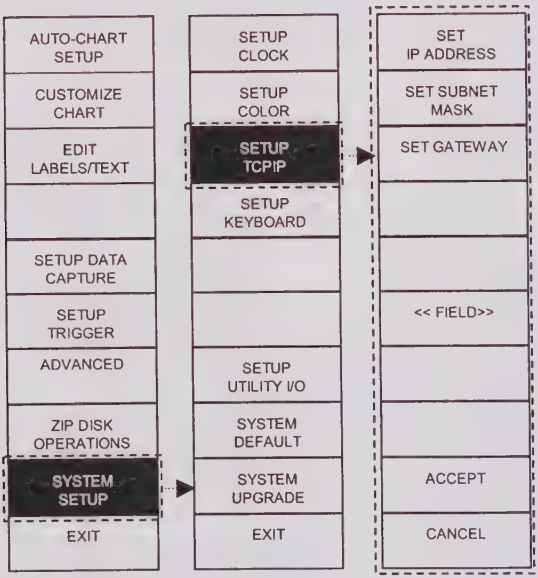


Figure 16, Set TCP/IP

TO SETUP THE RECORDER FOR COMMUNICATION WITH YOUR COMPUTER SYSTEM:

1. Press the [SYS] hotkey and select the SYSTEM SETUP and SETUP TCPIP softkeys.
2. Select from SET IP ADDRESS, SET SUBNET MASK, SET GATEWAY to modify parameters.
3. Press <<FIELD>> to highlight each field in the lower text area. To make a setup selection, use encoder wheel.
4. Press ACCEPT to apply changes.

Setup Keyboard

Use SETUP KEYBOARD to enable/disable continuous automatic printing of channel ID numbers. The ID is repeated every 128 characters (in synch with the text buffers) or once about every two pages.

[SYS]

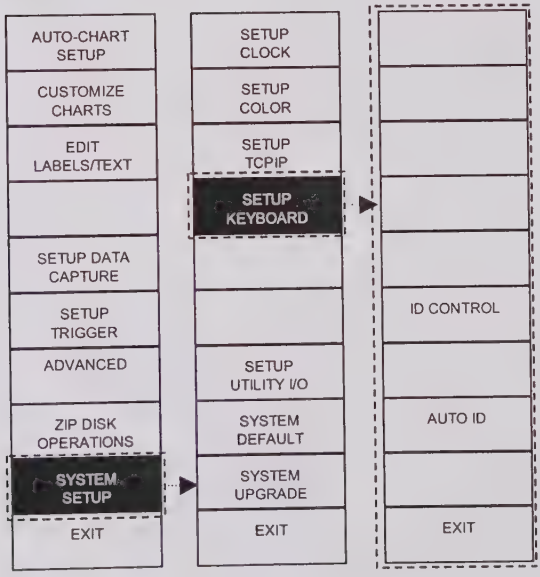


Figure 17, Keyboard

TO ENABLE/DISABLE CHANNEL ID NUMBERING:

1. Press the [SYS] hotkey, then select the SYSTEM SETUP, SETUP KEYBOARD softkeys.
2. Press ID CONTROL to toggle between Chart Only and Chart and Display to administer the change to one or both.
3. Select AUTO ID to toggle the Auto ID function on/off. Use the encoder wheel to select a label type in the lower text area.

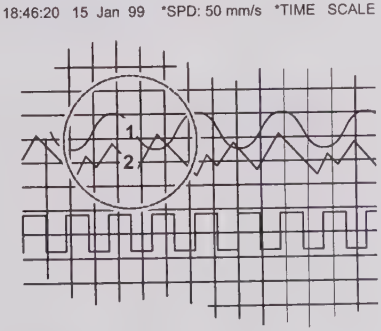
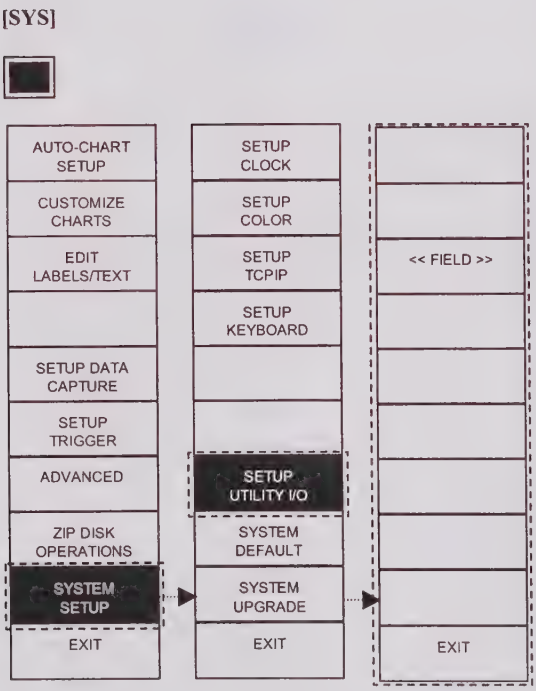


Figure 18, Channel ID Numbers on Waveforms

The [ID] hotkey can also be used to enable printing of the channel ID number on each waveform when desired.

Setup Utility I/O

SETUP UTILITY I/O is used to configure Pin 13 of the Utility I/O port for on-demand buffer (ODB) print or remote ID. Also use this funtion to select a Battery Mode option.



TO ENABLE/DISABLE ODB PRINT, CHANNEL ID NUMBERING OR TO SELECT A BATTERY MODE:

1. Press the [SYS] hotkey, then select the SYSTEM SETUP, SETUP UTILITY I/O softkeys.
2. Press << FIELD >> to toggle functions.
3. Use the encoder wheel to select an option in the lower text area.

The extent of protection afforded by BATTERY MODE depends on the charge present on the battery. If battery voltage is or becomes insufficient to maintain system power, the battery will power down the system. If Battery Mode is active when power is lost, an asterisk appears in the upper left corner the display and chart printing will stop.

Figure 19, Utility I/O

Normal battery mode sustains data capture functions during brief periods of power loss. Auto archive operates at standard rates but captures are not aborted. Data could be lost.

Quick battery mode powers down the system as soon as power loss is detected. Any active capture is aborted and if Auto Archive is enabled, the captured data is archived to Zip at the fastest possible rate.

System Default

The SYSTEM DEFAULT function is used to return all system settings to factory default settings. SYSTEM DEFAULT provides an easy way to quickly clear undesirable settings and replace them with useable, pre-programmed settings.

[SYS]

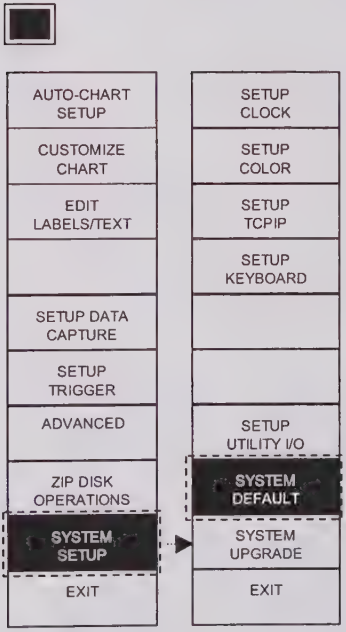


Figure 20, System I/O

TO RETURN ALL SYSTEM SETTINGS TO FACTORY DEFAULT SETTINGS:

1. Press the [SYS] hotkey, then select the SYSTEM SETUP and SYSTEM DEFAULT softkeys. You will be prompted to 'Verify…are you sure?'. Press YES to verify.

Speed Functions

The front-panel [SPD] hotkeys allow you to instantly effect faster/slower chart speeds of [1], [5], [25], or [50] mm/second [SEC], mm/minute [MIN], or mm/hour [HR].

Speed modifications can also be made through the SET SPEED, ADVANCED menu command to select a real-time recording speed other than those which are preset, and also to:

- Select the motor clock source: INTERNAL or EXTERNAL.
- Select the display speed: NORMAL or TREND.
- Increase motor accuracy by compensating for physical characteristics of the drive roller.

The time base of the display is synchronized proportionally with the time base and chart speed of the recorder. As a faster chart speed is selected, the equivalent display time base will display.

NOTE **THE RECORDER DOES NOT AUTOMATICALLY CLEAR THE DISPLAY WHEN SPEED IS CHANGED, THEREFORE, IT IS POSSIBLE TO ACCUMULATE MULTIPLE TIME BASES AND AMPLIFIER SETTINGS ON ONE SCREEN.**

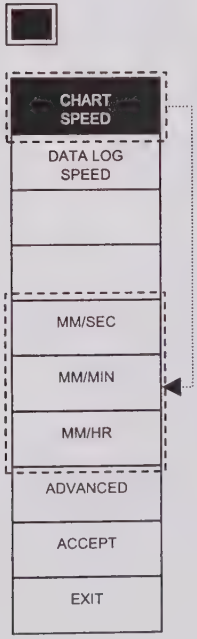
NOTE **MEASUREMENT AND TIME STATISTICS ARE ONLY VIEWABLE FOR DATA THAT IS DISPLAYED USING THE CURRENT USER SETTINGS AND SPEED. A NO-READING INDICATOR WILL BE SHOWN OTHERWISE.**

Chart Speed

The SET SPEED, CHART SPEED menu command is used to select a real-time recording speed other than a pre-set speed.

NOTE **THE SPD HOTKEYS ON THE FRONT PANEL PERMIT QUICK SPEED CHANGES WITHOUT THE NEED TO ACCESS THIS MENU.**

[SPD]



TO MODIFY CHART SPEED USING THE SET SPEED MENU:

1. Press the [SPD] hotkey and the CHART SPEED softkey to display available real-time recording speed types.
2. Press one of the speed type softkeys (mm/second [SEC], mm/minute [MIN], or mm/hour [HR]) to define the speed type.
3. Use encoder wheel to select from values in the bottom text area.
4. Press ACCEPT to apply the change.

TO MODIFY SPEED DIRECTLY FROM THE FRONT PANEL PRESET SPEED HOTKEYS:

1. Press one of the speed value hotkeys ([1], [5], [25], or [50]) to immediately slow down (lower value) or speed up (higher value) recording and continue to measure speed in the present speed type ([SEC], [MIN], or [HR]).
2. To change the speed type ([SEC], [MIN], or [HR]), you must first select a new type before entering a new speed value. Press the [HR], [MIN], or [SEC] key to select a new speed type, then press one of the speed value hotkeys.

Figure 21, Set Speed

Display Speed

Two methods of DISPLAY SPEED control are supported from the SET SPEED menu: NORMAL (default) and TREND.

The display may also be frozen in order to attain signal and time measurements using the cursors.

[SPD]

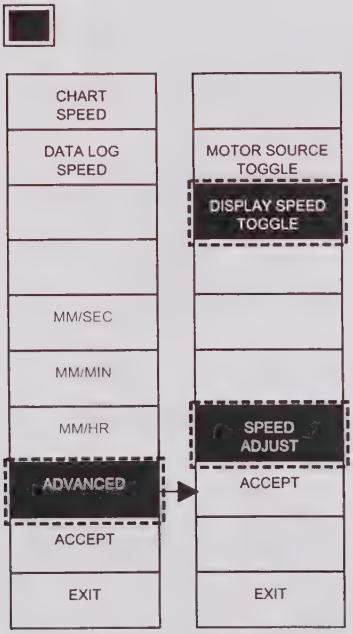


Figure 22, Set Speed

TO MODIFY DISPLAY SPEED:

1. Press the [SPD] hotkey, then select the ADVANCED softkey.
2. Press DISPLAY SPEED TOGGLE to select from NORMAL or TREND in the lower text area.
3. Press ACCEPT to effect the change.

TO MODIFY INTERNAL SPEED:

1. Press SPEED ADJUST and use the encoder wheel to modify the percentage displayed in the lower text area.
2. Press ACCEPT to effect the change.

Motor Source Toggle

The MOTOR SOURCE TOGGLE command allows configuration of an external stepper-motor timing source to be referenced in place of the internal clock.

Typically, the print rate of the stepper motor is referenced to a dedicated internal clock specifically tasked with stepper-motor timing control. For some applications, it may be convenient to reference the speed of the stepper motor to an external source that you supply.

[SPD]

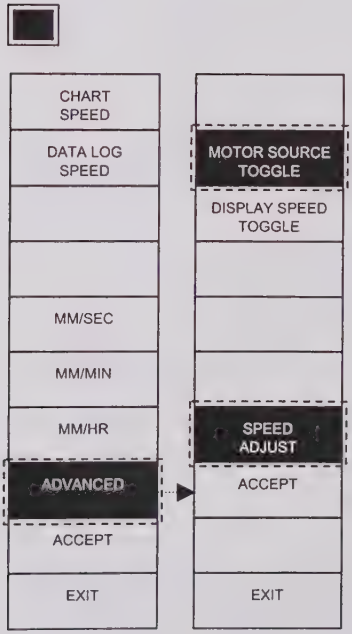


Figure 23, Set Speed

This is especially useful when you want the stepper motor speed to be controlled by a variable other than time. For example, it might be more meaningful to monitor railroad measurements as functions of distance. Motor accuracy can be increased by using SPEED ADJUST to compensate for physical characteristics of the drive roller.

TO CONFIGURE AN EXTERNAL STEPPER-MOTOR TIMING SOURCE TO BE REFERENCED IN PLACE OF THE INTERNAL CLOCK:

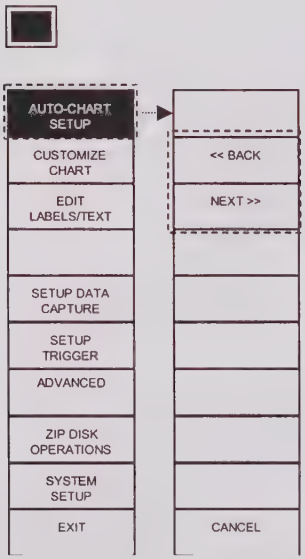
1. Connect your input stepper-motor clock source to pin 10 of the rear-panel Utility I/O port.
2. Connect the associated ground to pin 12 of the Utility I/O port.
3. Press the [SPD] hotkey and select the ADVANCED softkey.
4. Press MOTOR SOURCE TOGGLE until EXTERNAL is displayed in the lower text area.
5. To increase motor accuracy, select SPEED ADJUST and specify the desired percentage.
6. Press ACCEPT to complete the selection.

Chart Setup Functions

Auto-Chart

Any of the default chart formats may be modified and saved to a RUN CHART softkey.

[SYS]



TO MODIFY A DEFAULT CHART AND SAVE IT AS AN AUTO-CHART:

1. If desired, return all chart formats to their factory default settings first using the DEFAULT ALL CHARTS command.
2. Modify a chart by pressing the [SYS] hotkey, the AUTOCHART SETUP softkey, and using the <<BACK and NEXT>> softkeys to access each formatting option (displayed in the lower text area).
3. Use the encoder wheel to select options within each menu.
4. Press NEXT>> after the last selection to save this format to one of the four RUN CHART softkeys.

Figure 24, Auto-Chart

NOTE **ANY CHART FORMATS CREATED IN AUTO-CHART SETUP OR CUSTOMIZE CHART ARE STORED IN RUN CHART (1-4) UNTIL YOU REPLACE THEM WITH A NEW FORMAT.**

Customize Chart Setups

Before customizing charts, try using the four default chart formats, or make modifications with AUTO-CHART SETUP command. Use the CUSTOMIZE CHART command only when a more sophisticated option is required.

Chart formats created in AUTO-CHART SETUP or CUSTOMIZE CHART are stored in RUN CHART (1-4) until you replace them with a new format. When the RECALL SETUP softkey is pressed, present settings are immediately overridden and replaced with stored settings.

[SYS]

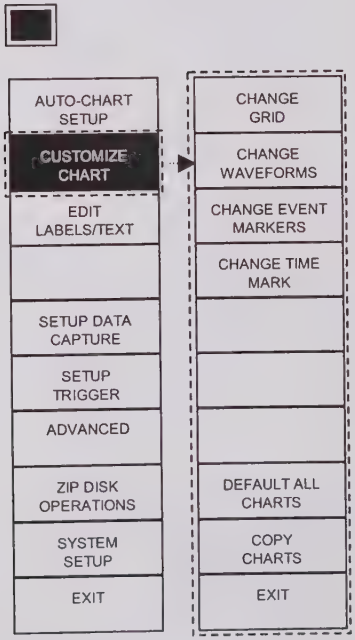


Figure 25, Chart Setup

CUSTOMIZE CHART allows you to customize any existing chart setup. Previously-saved settings can be recalled from a Zip™ disk and newly customized settings can be saved to Zip.

Using the CUSTOMIZE CHART menu, the grid, waveforms, event markers, and time marks can be modified to create a chart that is suited to your unique requirements.

TO CUSTOMIZE CHARTS:

1. Run the chart you wish to modify using the RUN CHART command.

2. While the chart is running, customize your selection by pressing the [SYS] hotkey and the CUSTOMIZE CHART softkey to access advanced options.

Change Grid

[SYS]

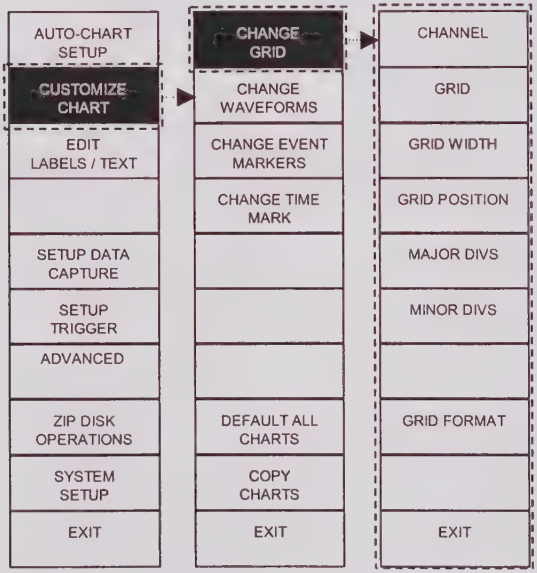


Figure 26, Grid Setup

TO MODIFY THE GRID DISPLAY:

1. Run the chart you wish to modify using the RUN CHART command.

2. Press the [SYS] hotkey, then select the CUSTOMIZE CHART, CHANGE GRID softkeys. Specify options by turning the encoder wheel or entering a value through the keypad, then press Enter.

   When using the CHANGE GRID option or editing TEXT BUFFERS, the right edge of the grid will move dynamically to each chart location as you turn the encoder wheel or enter a value using the keypad.

3. If desired, turn GRID on/off by toggling the softkey.

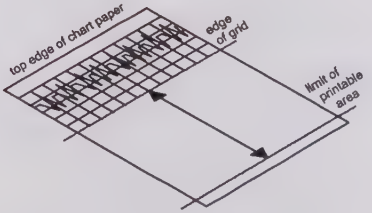


Figure 27, Grid Layout Example

Change Waveforms

[SYS]

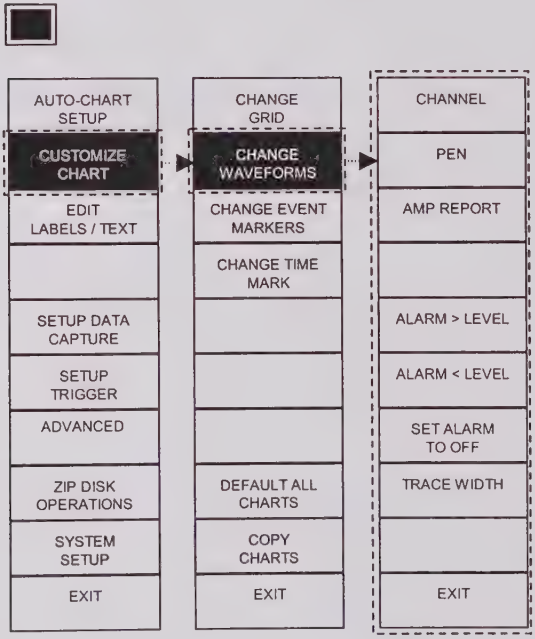


Figure 28, Trace Setup

TO MODIFY WAVEFORM PARAMETERS:

1. Run the chart you wish to modify.
2. Press the [SYS] hotkey, then select the CUSTOMIZE CHARTand CHANGE WAVEFORMS softkeys.
3. Specify options using the encoder wheel to select a value, or toggle the softkeys where applicable.

TO PRINT AMPLIFIER SETTINGS ON THE CHART:

1. Press the [SYS] hotkey, then select the CUSTOMIZE CHART, CHANGE WAVEFORMS, and toggle the AMP REPORT softkey ON.

NOTE **ADJUSTMENTS TO TRACE THICKNESS WILL AFFECT ALL WAVEFORMS. HOWEVER, THIS ADJUSTMENT APPLIES ONLY TO THE PAPER RECORDING.**

Selections for the PEN are: UP (hide waveform) DOWN (show waveform).

Signal conditioner settings are printed in the last 40 character spaces of the annotation buffer.

Change Event Markers

Use the CHANGE EVENT MARKERS command to turn printing of the event marker On/Off, select the print position (location) of the event marker, or select a style for the event markers.

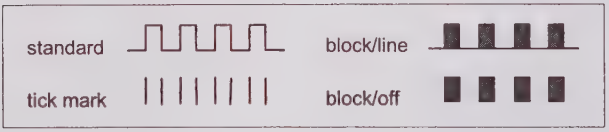


Figure 29, Event Marker Styles

NOTE **THE EVENT STYLE SELECTIONS TAKE EFFECT GLOBALLY - THEY APPLY TO ALL EVENTS ONCE SELECTED.**

The system event marker provides a convenient way to place a mark on the chart that can be used to mark the start or end at some particular change in a test.

TO CAUSE THE SYSTEM MARK AT THE TOP OF THE CHART TO ACTIVATE BASED ON EVENT STYLE:

1. Press the MARK hotkey.

[SYS]

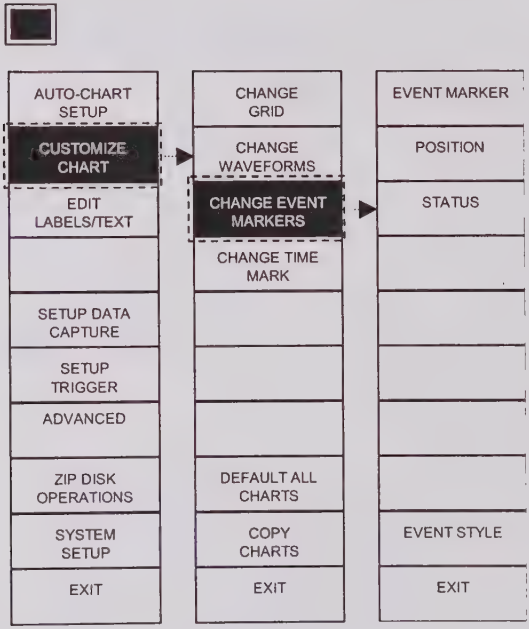


Figure 30, Event Setup

TO SELECT A POSITION FOR AN EVENT MARKER:

1. Press the [SYS] hotkey, then select the CUSTOMIZE CHART, CHANGE EVENT MARKERS softkeys to access advanced menu options.

2. Use the encoder wheel to select the EVENT MARKER to be changed (1-16 or System) and the POSITION of the marker on the chart.

TO PRINT EVENT MARKERS ON THE CHART:

1. Toggle the STATUS softkey to On.

2. Use the encoder wheel to toggle EVENT STYLE among standard, tick mark, block/line, block/off.

Change Time Mark

[SYS]

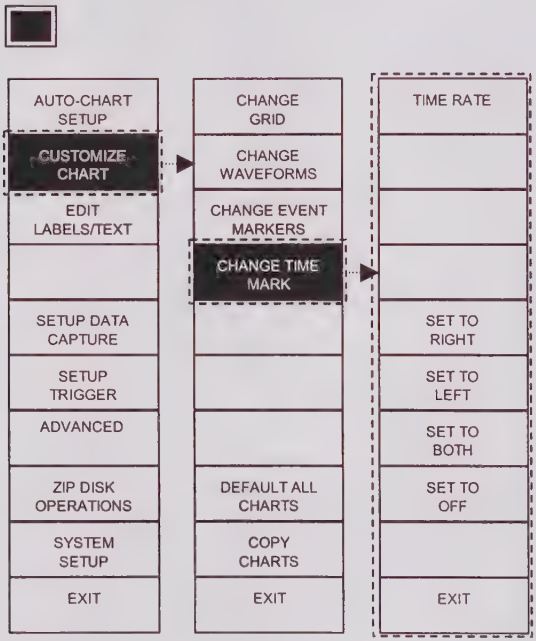


Figure 31, Timer Setup

TO SELECT THE TIMER RATE FOR TRI-LEVEL TIMING MARKS:

1. Press the [SYS] hotkey, then select the CUSTOMIZE CHART, CHANGE TIME MARK, and TIMER RATE softkeys.

2. Use the encoder wheel to select a time mark reference rate.

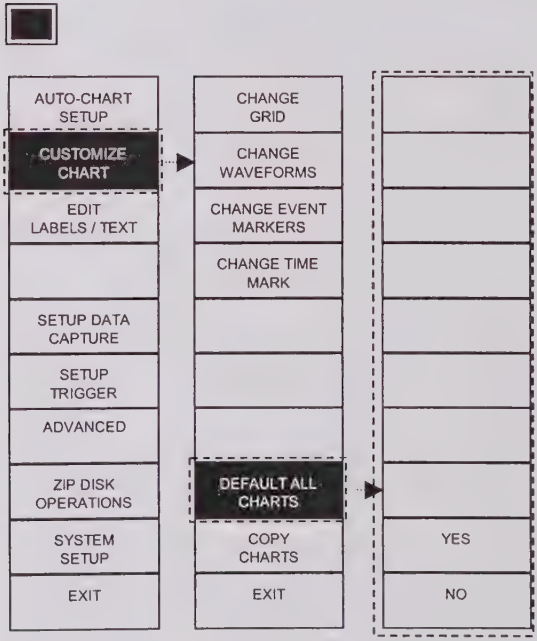
TO TURN PRINTING OF TIMER MARK ON AND OFF, AND TO SELECT WHETHER THE TIMING MARK WILL BE PRINTED ON THE CHART'S LEFT, RIGHT, OR BOTH EDGES:

1. Select SET TO RIGHT, SET TO LEFT, SET TO BOTH, or SET TO OFF to modify printing of the timing mark on the chart.

Default All Charts

The DEFAULT ALL CHARTS command immediately clears present chart settings and replaces them with the four factory default formats, providing a convenient way to clear existing layouts.

[SYS]

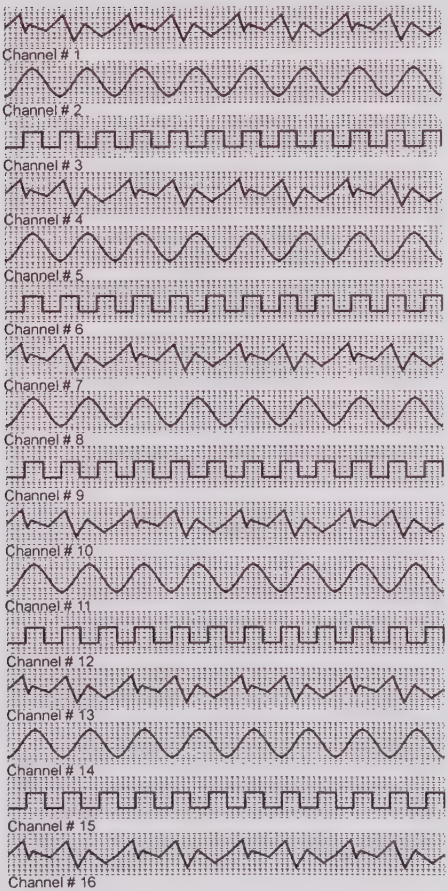


TO RETURN ALL CHARTS TO FACTORY-DEFAULT FORMATS:

1. Press the [SYS] hotkey.
2. Select the CUSTOMIZE CHART, DEFAULT ALL CHARTS softkeys.
3. You will be prompted with a message in the lower text area to 'Verify…are you sure?' Press YES to verify.

Figure 32, Chart Setup

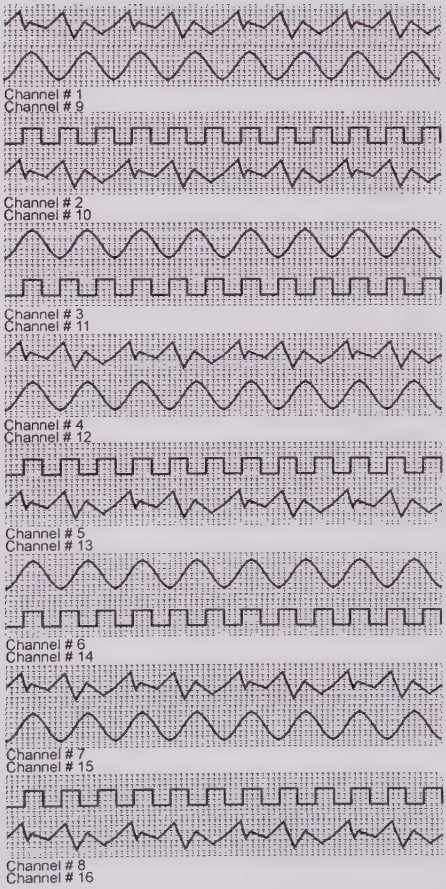
Default Chart 1 Layout



Grids.....16
Individual Channels.....16
Channels per Grid.....1
Major Divisions.....2
Minor Divisions per Grid.....10

Figure 33, Default Chart 1 Layout

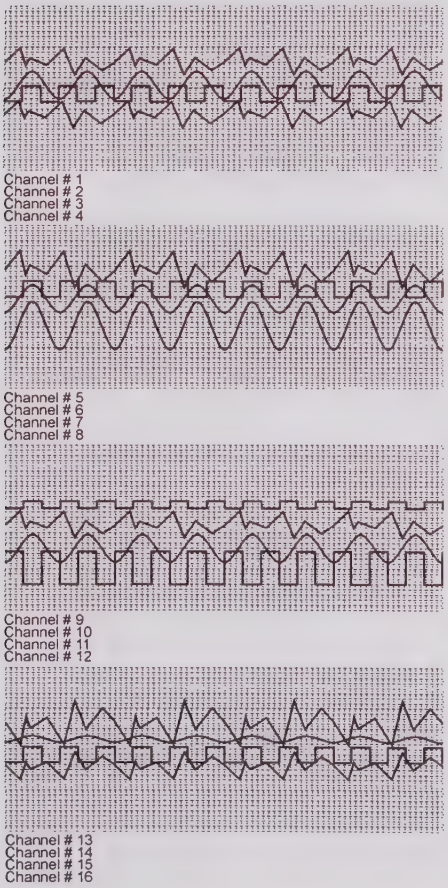
Default Chart 2 Layout



Grids	8
Individual Channels	16
Channels per Grid	2
Major Divisions	4
Minor Divisions per Grid	20

Figure 34, Default Chart 2 Layout

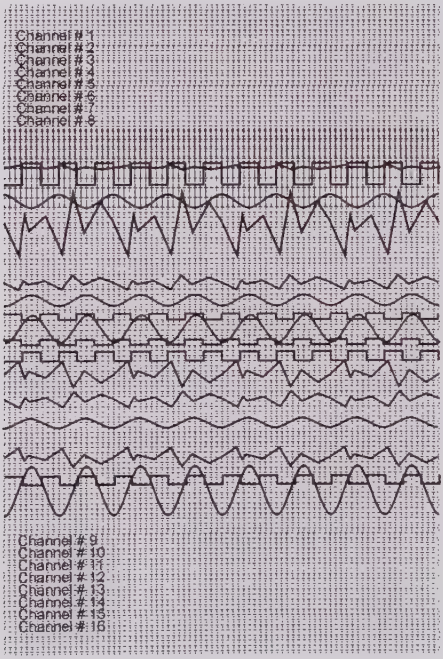
Default Chart 3 Layout



Grids.....4
Individual Channels.....16
Channels per Grid.....4
Major Divisions.....8
Minor Divisions per Grid.....40

Figure 35, Default Chart 3 Layout

Default Chart 4 Layout



Grids	1
Individual Channels	16
Channels per Grid	16
Major Divisions	40
Minor Divisions per Grid	200

Figure 36, Default Chart 4 Layout

Copy Charts

The COPY CHARTS command is used to copy one chart layout setup to another. This is convenient for copying an existing format stored in RUN CHART and making minor modifications to it, or to create a new layout.

Both customized and default layout formats can be copied using COPY CHARTS.

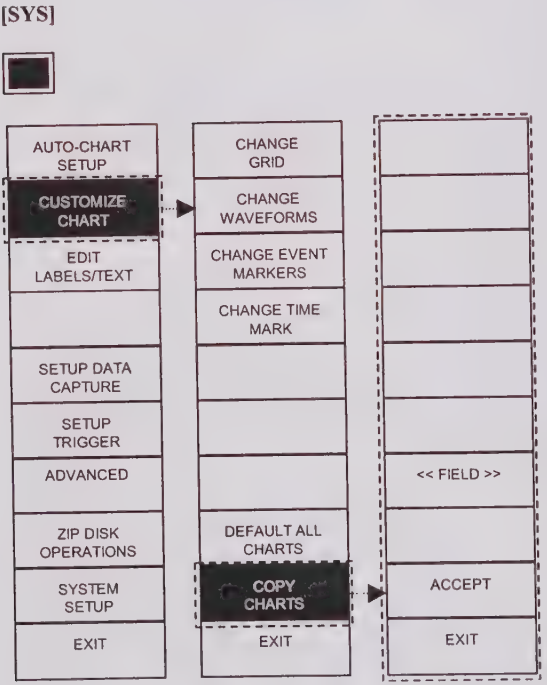


Figure 37, Copy Charts

TO COPY A CHART FORMAT:

1. Select the [SYS] hotkey, then press the CUSTOMIZE CHART, COPY CHARTS softkeys.
2. You will be prompted in the lower text area to 'Select a source chart…' (from which to copy).
3. Use the encoder wheel to select a chart to copy, then press the ACCEPT softkey.
4. Press the <<FIELD>> softkey to access the copy 'to Chart' field. Use the encoder wheel to select a chart to overwrite.
5. Press the ACCEPT softkey to overwrite the chart selected.

Editing Text Buffers

The EDIT LABELS/TEXT command is used to edit any of the system's channel text buffers, on-demand text buffers, the system log, or to one of these on-demand. The menu also allows positioning of the channel text buffer or on-demand text buffer anywhere on the chart.

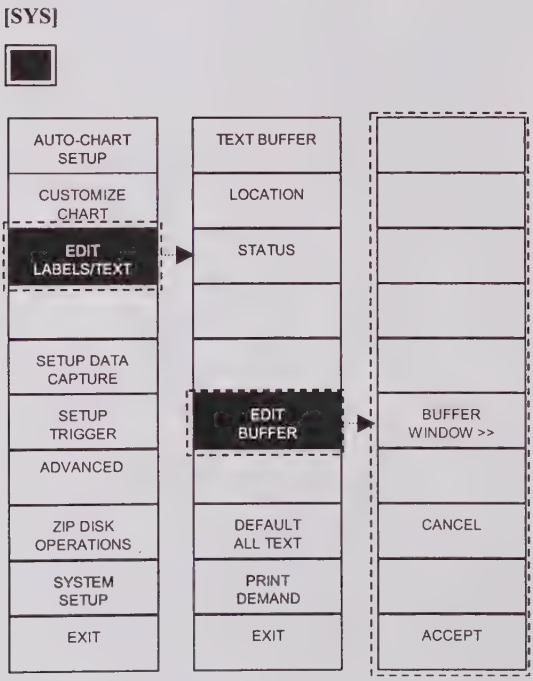


Figure 38, Text Setup

TO DISPLAY/PRINT TEXT:

1. Press the [SYS] hotkey, then select the EDIT LABELS/TEXT softkey.
2. Press STATUS to toggle on/off.

TO EDIT A TEXT BUFFER:

1. Press TEXT BUFFER. Select options using the encoder wheel.
2. Press EDIT BUFFER, then BUFFER WINDOW >> to toggle among options in the lower text area.

TO SELECT TEXT POSITION:

1. Press LOCATION. Use the encoder wheel to select position.

TO PRINT THE TEXT BUFFER:

1. Press PRINT DEMAND.

NOTE **THE TEXT BUFFER CAN BE POSITIONED AND ENABLED THROUGH OTHER MENUS. PRINTING OF ON-DEMAND TEXT BUFFER CAN BE ACTIVATED THROUGH THE UTILITY PORT.**

Input Configuration

Signal conditioning and data capture memory are contained on Signal Modules. Up to two Signal Modules (SMs) can be installed. Each module supports eight waveform inputs and eight event inputs. Each input channel has two physically separate input paths:

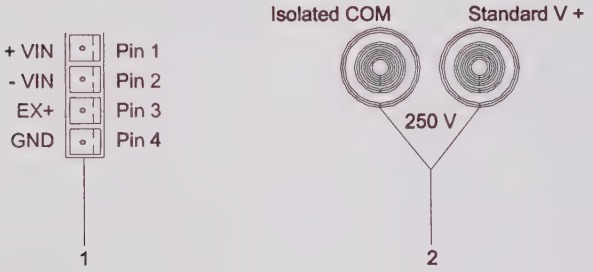


Figure 39, Dash 16u Input Signal Configuration

1 Terminal block connections are provided to connect low-level differential signals and thermocouples.

2 Banana jacks accommodate single-ended voltages with reference to isolated common.

All inputs and excitation are isolated to 250 V as DC or RMS from chassis and other channels. Excitation is not considered an input and should never be connected to a voltage source. This isolation specification applies to all measurements.

Amplifier & Channel Setup

Complete amplifier configuration before setting up channels.

This includes defining amplifier types in use, operating substage (attenuation), and if user scaling is used, the ratios of user units to volts. These initial steps control the operation of the amplifiers, resolution of units, and characteristics for all ensuing operation. Range, offset , etc. can be adjusted after making these settings.

Signal Conditioning Settings

Signal amplification is specified in terms of the full-scale chart recording. Recorder sensitivity and signal conditioning settings are specified by channel and include:

- ATTENUATION
- RANGE
- OFFSET
- DC / GND (single-ended, differential)
- PEAK-TO-PEAK / RMS (single-ended, differential, bridge)
- DSP / FILTER
- USER SCALING (single-ended, differential, bridge)
- CALIBRATION

Built-in signal conditioners automatically report their gain and position settings in the last 40 spaces of the channel's annotation buffer.

Measurement range is specified by setting ATTENUATION, RANGE, and OFFSET.

Define Input Types

Define the type of input channel to be used by setting the amplifier type to the correct type and to report in the correct engineering units. These settings will be remembered after power down.

[AMP]

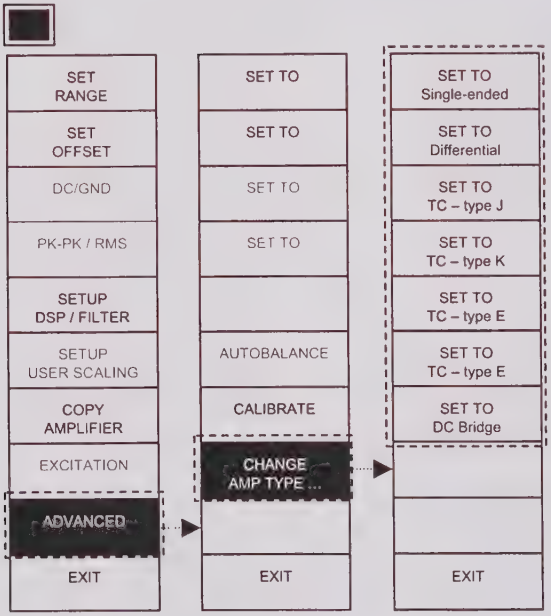


Figure 40, Set Amplifier

TO MODIFY INPUT TYPE:

1. Press the [AMP] hotkey. The lower text area indicates the channel's input type (no input type will be indicated if the channel's input is single-ended).
2. Press the ADVANCED, CHANGE AMP TYPE softkeys, and select the correct type for each channel.
3. If thermocouple types are used press EXIT, EXIT and select the F / C softkey to toggle between °F or °C.

Set Attenuation

The SET TO... commands limit the maximum input and sensitivity of the amplifier, particularly the range (full scale span), and the amount of available offset.

[AMP]

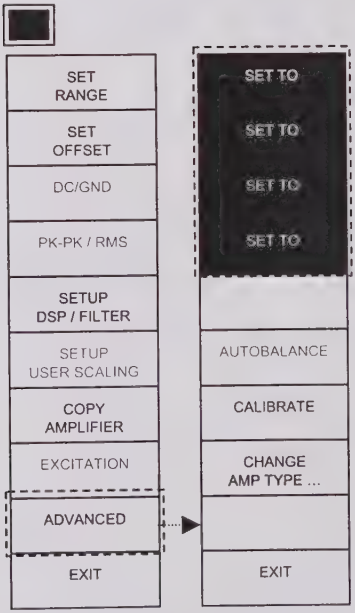


Figure 41, Set Attenuator

TO SET ATTENUATION FOR DC BRIDGE, SINGLE-ENDED, OR DIFFERENTIAL INPUT:

1. Press the [AMP] hotkey for the channel to be modified. The bottom text area indicates the channel's input type (no input type will be indicated if the channel's input is single-ended) and present Attenuator setting.

2. Press one of the SET TO softkeys, and select the correct attenuation for each channel.

TO SET ATTENUATION FOR THERMOCOUPLE INPUT SEE:

Calibrate Input Channels, Page 76.

Set User-defined Engineering Units

When recording changes in temperature, pressure, or any other quantity that is not voltage, it is often useful to print and view data in numeric engineering units instead of as waveforms. All signal information enters the recorder as electrical voltage.

Numeric scaling begins with selecting the voltage sensitivity of the channel full scale. User scaling is used to redefine the voltage sensitivity in terms of the engineering units desired. The recorder will then convert all of the signal voltage data into the engineering units specified.

The SETUP USER SCALING option applies only to voltage input types.

When user scaling is used, all appropriate menus will be displayed in the engineering units defined. Engineering units are determined by using the first (2) characters of each of the input sources' engineering units along with a mathematical indicator.

Implementing Differentiation & Integration Options

The following are guidelines for implementing the Differentiation or Integration DSP options and USER SCALING.

With a known time constant, outputs can be scaled to true V/sec readings by entering a user-definable scale factor:

$$\text{output [V/sec]} = \text{scale factor [1/sec]} \times \text{output [V]}$$

where scale factor is: $\frac{1}{\text{T.C.[sec]}} \times \frac{1}{10}$

The 1/10 takes into account an additional resolution factor added to recorder software.

Time constant for the user-definable scale factor:

$$\text{output [V·sec]} = \text{output [V]} \times \text{time constant [sec]}$$

TO SCALE OUTPUTS TO TRUE V/SEC READINGS BY ENTERING A USER-DEFINABLE SCALE FACTOR:

[AMP]

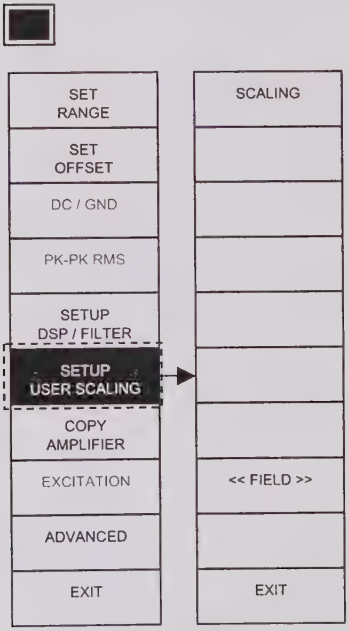


Figure 42, User Scaling

1. Press [AMP] and select the SETUP USER SCALING softkey.
2. Select the SCALING hotkey and toggle to CUSTOM user scaling.
3. Use <<FIELD>> to set scale to 1.000, set span to scale factor, and set user units to "V/sec".

TO IMPLEMENT THE INTEGRATION DSP OPTION AND USER SCALING:

Depending on the application, the DC Block can be turned on.

In the SETUP DSP/FILTER menu, select Integrate and set time constant between 1 and 1000 msec.

Specify DSP / FILTER Settings

Peak-to-peak and RMS recording modes can be selected for any specified channel.

NOTE **IF RMS IS ENABLED, FILTER SETTINGS DO NOT APPLY.**

[AMP]

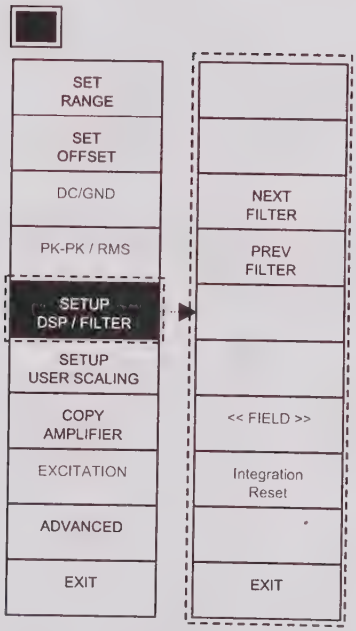


Figure 43, DSP/Filter

TO SETUP DSP/FILTER:

1. Press [AMP] and SETUP DSP/FILTER.
2. Use the NEXT FILTER or PREV FILTER softkeys to display filter settings in the lower text area.
3. Use <<FIELD>> (if present) to highlight desired field in bottom text area of display.

TO SPECIFY DIFFERENTIATION FOR THE DSP OPTION:

1. Press [AMP], then SETUP DSP / FILTER.
2. Press NEXT FILTER or PREV FILTER until d/dt is displayed in the lower text area.
3. Use the << FIELD >> softkey and the encoder wheel to select a time constant and a suitable low pass frequency to attenuate high frequency noise.

Set DC or GND

DC/GND is used to set the channel signal to DC or to ground (GND).

[AMP]

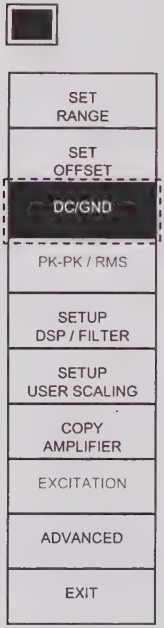


Figure 44, DC/GND

TO GROUND OR TO ENABLE THE CHANNEL'S INPUT SIGNAL:

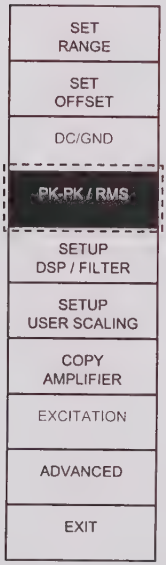
1. Press the [AMP] hotkey and select the DC/GND softkey to toggle between selections.

Set Peak-to-Peak RMS

Peak-to-Peak / RMS, implemented in the digital signal processor (DSP), is used to direct the DSP to take the input signal of the channel and perform root-mean-square (RMS) so what is recorded, displayed, and captured is the RMS of the signal and the end result is a true RMS calculation.

Peak-to-peak and RMS recording modes can be selected for any specified channel.

[AMP]



TO ENABLE THE CHANNEL'S INPUT SIGNAL TO PERFORM ROOT-MEAN-SQUARE:

1. Press the [AMP] hotkey, then select the PK-PK/RMS softkey to toggle between selections.
2. When RMS is enabled, the time constant can be adjusted the using SETUP DSP/FILTER command.

Figure 45, PK-PK/RMS

Setting Autobalance for the DC Bridge Input Type

AUTOBALANCE is used to add a factor to the input level so that the result is zero.

[AMP]

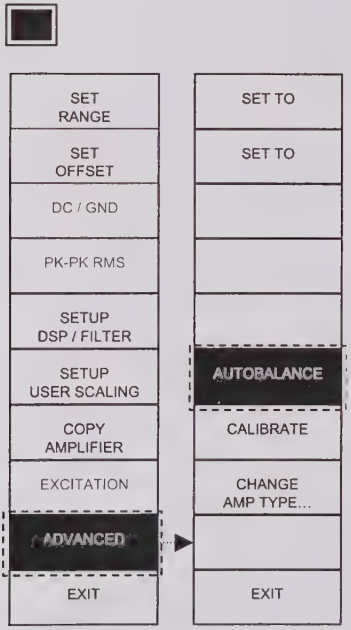


Figure 46, Autobalance

TO ADD A FACTOR TO THE INPUT LEVEL SO THE RESULT IS ZERO:

1. Ensure the transducer is in a zero condition (i.e. remove the load from the load cell).
2. Press the [AMP] hotkey and the ADVANCED softkey.
3. Use the encoder wheel and the SET TO… softkeys to select an attenuator setting.
4. Press AUTOBALANCE. Operation status is displayed in the lower text area.

Calibrate Input Channels

[AMP]

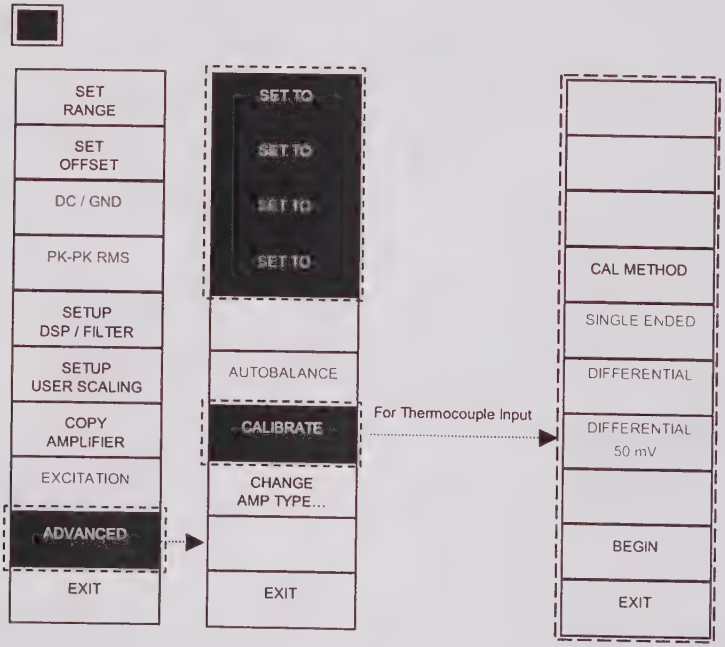


Figure 47, Calibrate Channels or Set Attenuator for DC Bridge, Single-ended, or Differential Input

Figure 48, Calibrate Channels or Set Attenuator for Thermocouple Input

NOTE **WHILE CALIBRATING OR VERIFYING DIFFERENTIAL INPUTS ON THE 50 MV RANGE, SIG- SHOULD NOT BE TIED TO SIGNAL COMMON, ALTHOUGH THE FACTORY-SUPPLIED CALIBRATION MODULE TIES THESE TWO SIGNALS.**

FACTORY-SUPPLIED CALIBRATION MODULES SHOULD USE A TRACEABLE BENCHTOP VOLTAGE SOURCE, AND OUTPUT SHOULD BE CHECKED WITH A TRACEABLE VOLTMETER.

NOTE **QUICK CAL CAN MASK A VARIETY OF ERRORS WHEN PERFORMED IMPROPERLY. QUICK CAL SHOULD NOT BE USED UNTIL THE FINAL STAGE OF THERMOCOUPLE CALIBRATION.**

PERFORM QUICK CAL AT ZERO DEGREES EXCEPT WHEN FIELD CONDITIONS WARRANT USING ANOTHER VALUE.

PERFORM QUICK CAL AFTER EVERY CALIBRATION.

TO CALIBRATE INDIVIDUAL CHANNELS:

1. Allow the unit to warm up at least 15 minutes and confirm the AMP selections for the input type are set correctly.

2. Press the AMP hotkey for the channel, press the ADVANCED softkey, then select the CALIBRATE softkey.

3. Press CAL METHOD to toggle among Module (to perform calibration using the module supplied by Astro-Med, Inc.), Zero Only, and Manual to apply alternate calibration. If Module is selected, set the GND/CAL switch on the module to the GND position. If Manual is selected, select the channel to calibrate and apply 0.0 V to both inputs.

4. Select from Single-ended, Differential, or Differential 50mV calibration mode.

5. Press BEGIN. Status of calibration is displayed in the lower text area. If a "fail" message appears, ensure the correct settings are applied and repeat.

TO CALIBRATE BRIDGE INPUT TYPES:

6. Perform the calibration steps for calibrating individual channels and continue as follows.

7. Remove the calibration module. Ensure the channel is wired for the bridge input type.

8. Confirm that selections for the input type are set correctly.

9. Confirm that amplifier settings are correct.
10. Press the ADVANCED softkey in the AMP menu
11. Select an attenuator setting.
12. Press AUTOBALANCE. Status of calibration will be displayed in the lower text area. If a fail message appears, ensure that the correct attenuator setting has been selected and press AUTOBALANCE again.

TO CALIBRATE THERMOCOUPLE INPUT TYPES:

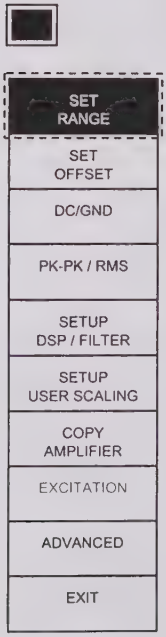
6. Perform the calibration steps for calibrating individual channels, and continue as follows.
7. Remove the calibration module.
8. Confirm the channel is wired for the thermocouple input type.
9. Confirm that the selections for the input type are set correctly.
10. Confirm that related amplifier settings are set correctly.
11. Press the ADVANCED softkey in the AMP menu, select CALIBRATE, then press QUICK CALIBRATION.
12. Press SET TO to select a temperature reference: 0 °C, 100 °C, or 350 °C.
13. Apply the known temperature to the thermocouple input.
14. Press BEGIN to apply the temperature reference to the input. Status of the calibration will be displayed in the text area. If a 'fail' message appears, ensure that the correct temperature reference has been selected and repeat.

Set Range

The SET RANGE command is used to determine the measurement span at full scale.

Range options are determined by attenuator settings.

[AMP]



TO DETERMINE THE MEASUREMENT SPAN AT FULL SCALE

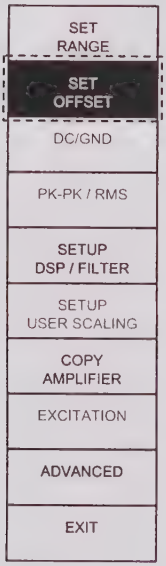
1. Press the [AMP] hotkey, then select the SET RANGE softkey. Current range, offset, DSP/ filter setting, and input type are indicated in the lower text area.
2. Press the SET RANGE softkey.
3. Use the encoder wheel or the keypad to set a range in the lower text area. Positive (clockwise) movement of wheel will move signal in an upward direction on the chart. This corresponds numerically to a negative voltage on the display. This allows the number to be used as the value at the center of the channel (or measurement range).

Figure 49, Set Range

Set Offset

When positioning the waveform in the channel, the center of the grid is used as the reference location. The SET OFFSET command is used to specify the center point of the grid.

[AMP]



Some waveform input signals may contain an unwanted direct-current (DC) component. The signal's DC component may make it difficult to bring the waveform data of interest onto the chart. In these cases, offset is used to remove a portion of the waveform's DC component and bring the data of interest onto the chart for recording and analysis.

The offset parameter can be thought of as either zero suppression or baseline offset, depending on the application.

Offset options are determined by attenuator settings.

TO SPECIFY THE GRID CENTER POINT:

1. Press the [AMP] hotkey, then select the SET OFFSET softkey. Current range, offset, DSP/ filter setting, and input type are indicated in the lower text area.

2. Press the SET OFFSET softkey. Use the encoder wheel or the keypad to set an offset value in the lower text area.

Figure 50, Set Offset

Copying Amplifier Settings

The COPY AMPLIFIER command is a convenient way to speed up the process of setting up similar channels. The command is used to copy the signal conditioner settings of one channel (source channel) to another channel or to all channels.

Another convenient way to copy the amplifier settings of one channel to all channels is by using AstroSET ™ C. Simply specify settings for one channel in the ZERO AND GAIN menu and use the MASTER CHANNEL option to copy those settings to all channels.

[AMP]

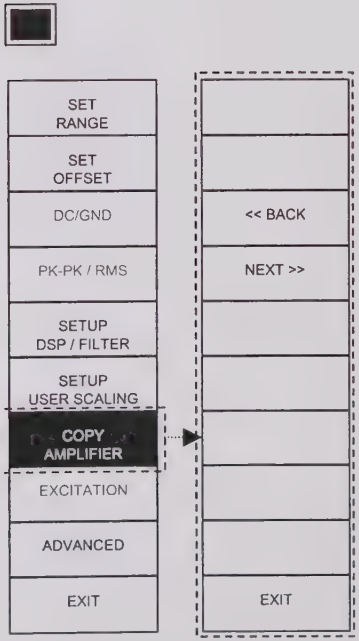


Figure 51, Copy Amplifier

TO COPY SIGNAL CONDITIONER SETTINGS FROM ONE CHANNEL TO ANOTHER, OR TO ALL CHANNELS:

1. Press the [AMP] hotkey, then select the COPY AMPLIFIER softkey.

2. Use the NEXT>> softkey to access functions for Source Channel, Destination Channel, and Setup options. Use the encoder wheel to select from options available for each function.

3. You will be prompted to 'Verify . . . are you sure?' by pressing the NEXT>> softkey after all selections have been made.

Printing Amplifier Settings

Built-in signal conditioners automatically report their gain and position settings in the last forty spaces of the channel's annotation buffer. Use the AMP REPORT ON command to print AMP settings on the chart.

Chapter 3
Real-time Operation

Real-time Recording

Run Chart

[MODE]

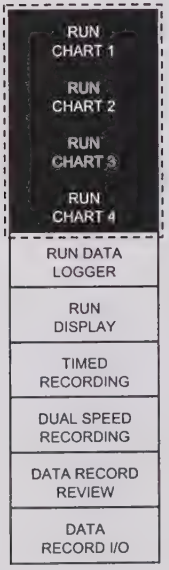


Figure 52, Start Menu

TO RUN A CHART:

1. Press the MODE hotkey, then select one of the RUN CHART softkeys (CHART 1-4) to begin recording.

TO RUN THE WAVEFORM DISPLAY:

1. Press MODE then select RUN DISPLAY to activate the real-time display in the active format.

TO START/STOP RECORDING:

1. Press the RUN/HALT hotkey.

Dual Speed Recording

The DUAL-SPEED RECORDING command allows you to toggle between two recording speeds – either as a result of a trigger or the passage of a duration of time.

[MODE]

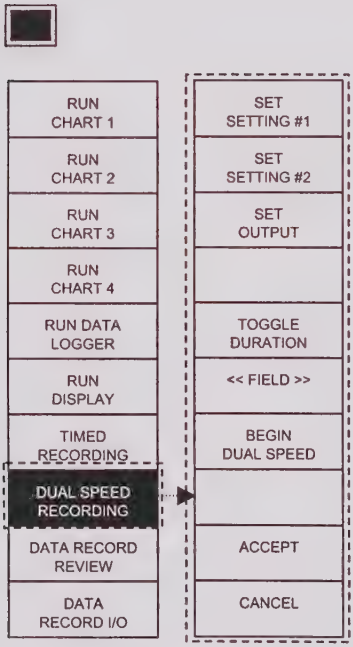


Figure 53, 2-Speed Setup

TO ENABLE DUAL-SPEED RECORDING:

1. Press the MODE hotkey, then select the DUAL SPEED RECORDING softkey.
2. Press a SET SETTING... softkey, and in the lower text area, make selections using the encoder wheel and the << FIELD >> softkey.
3. Select a chart format by pressing SET OUTPUT and using the encoder wheel to select a chart (1-4). Press ACCEPT to accept the change.
4. Select TOGGLE DURATION to establish a timed or triggered DUAL SPEED recording for each SETTING.
5. Press the ACCEPT softkey to accept the options selected.
6. Press BEGIN DUAL SPEED to activate dual speed recording. Status of the recording is displayed in the lower text area.

Timed Recording

TIMED RECORDING is used to specify a time to begin automatic recording.

[MODE]

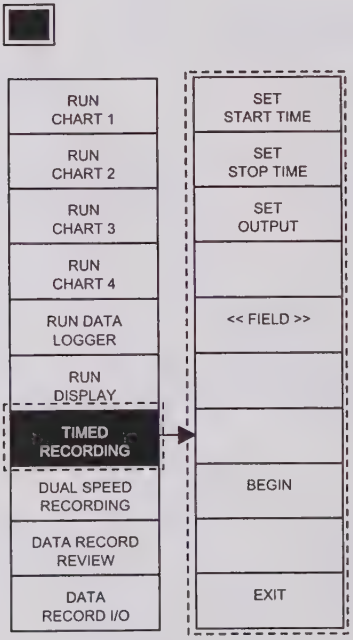


Figure 54, Timer Setup

TO SETUP A TIMED RECORDING:

1. Press the MODE hotkey, and select the TIMED RECORDING softkey.
2. Press SET START/STOP TIME and SET OUTPUT to define parameters for the recording. Press <<FIELD>> and use the encoder wheel to select settings.
3. Press BEGIN to activate.

Date Format: 01 Feb 94

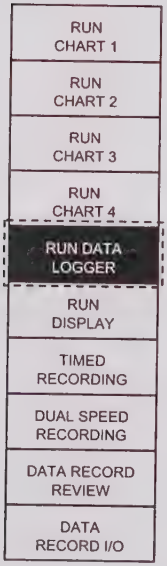
Time Format: 01:30:00 (24-hour period)

Data Logger

Run Data Logger

NOTE **THE ACCURACY OF OUTPUT DEPENDS ON SIGNAL CONDITIONER SETTINGS.**

[MODE]



TO DISPLAY THE DATA LOGGER:

1. Press the MODE hotkey, then select the RUN DATA LOGGER softkey.

TO SET THE DATA LOGGER PRINT SPEED:

1. Press MODE, then select RUN DATA LOGGER and DATA LOG SPEED. Use the encoder wheel to increase/decrease print speed.

OR

1. Press SPD and select CHART SPEED to display available real-time recording speed types.
2. Press one of the speed type softkeys (mm/sec [SEC], mm/min [MIN], or mm/hr [HR]) to define the speed type.
3. Use encoder wheel to select a speed value from the ranges presented in the bottom text area. Press ACCEPT to effect the change.

Figure 55, Data Logger

Set Data Log Speed

The DATA LOG SPEED command is used to determine how frequently waveform data is sampled and printed to paper. This command does not affect the display.

[SPD]

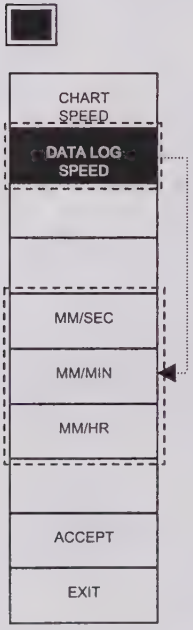


Figure 56, Set Speed

TO DETERMINE HOW FREQUENTLY WAVEFORM DATA IS SAMPLED AND PRINTED TO PAPER:

1. Press the SPD hotkey, then select the DATA LOG SPEED softkey to access softkeys for the recording speeds available.
2. Press one of these to define the measure of speed: line every "x" milliseconds, seconds, or minutes – for example, selection of 2 s/line means that a line of data is printed every two seconds.
3. Use encoder wheel to select a speed value from the ranges presented in the bottom text area.
4. Press ACCEPT to complete the selection.

Triggering Events

Although data captures can be set up to occur without a trigger, triggers are a frequently-used and useful way to define data record creation. Though triggers are used primarily with data capture, they may also be used to trigger a change in speed during dual-speed recording. When a valid trigger occurs, the associated front-panel LED illuminates.

Set Trigger Sources

[SYS]

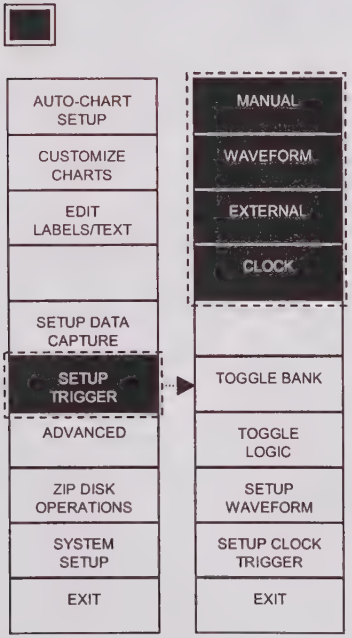


Figure 57, Main Trigger

A trigger source must be enabled for the recorder to recognize any triggers the source may generate. The SETUP TRIGGER command is used to set up and enable source-generated triggers.

In many circumstances, it is desirable to have data captures occur in response to a triggering event. Triggering events can be a user-initiated command, a defined waveform activity, a condition of time, or activity from an external source.

TO TURN ON TRIGGER SOURCES:

1. Press the SYS hotkey, then the SETUP TRIGGER softkey.

2. Press any of the top four soft keys turn trigger sources on/off.

Set Logical (AND/OR) Triggering Combinations

Waveform triggers can be combined in AND or OR relationships to create a large number of trigger options. The TOGGLE LOGIC command is used to apply AND/OR logic.

[SYS]

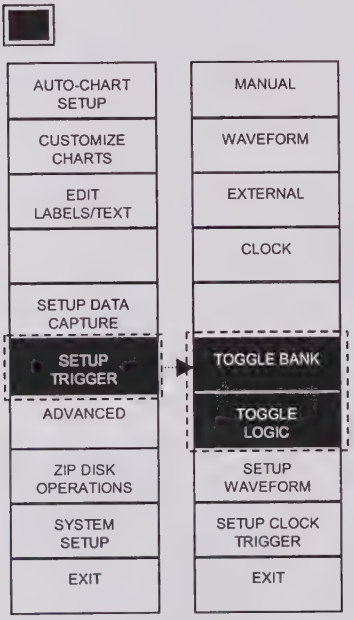


Figure 58, Toggle Logic

TO GROUP WAVEFORMS AS TRIGGER SOURCES:

1. Press the SYS hotkey, then the SETUP TRIGGER softkey.
2. Press TOGGLE BANK to access channels on each signal module installed.
3. PressTOGGLE LOGIC and use the encoder wheel to make selections in the lower text area and create AND/OR triggering combinations.

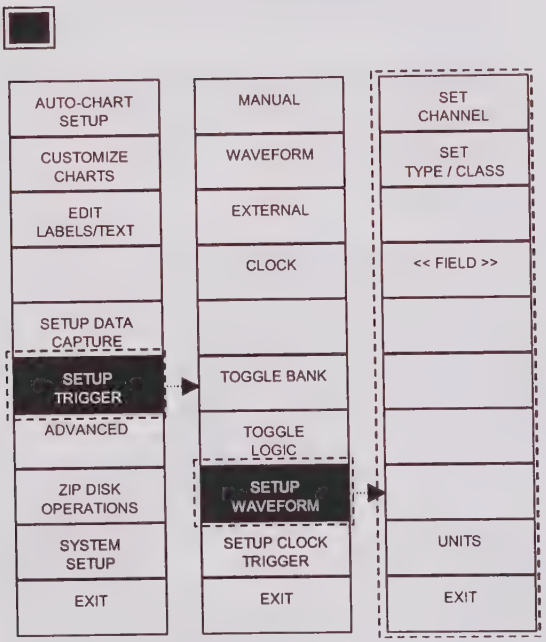
The AND function allows specification of groups of channels as a collective trigger source. Channels grouped using AND must all satisfy a condition simultaneously in order for a trigger to occur.

The OR function allows specification of any one channel in a group which can cause a trigger. Channels grouped using OR can individually satisfy a condition in order for a trigger to occur.

Set Waveform Triggers

The SETUP WAVEFORM command is used to define the conditions and signal levels at which an input signal will cause a trigger.

[SYS]



TO DEFINE SIGNAL CONDITIONS FOR EACH CHANNEL TO BE USED AS A TRIGGER SOURCE:

1. Press the SYS hotkey, then the SETUP TRIGGER softkey.
2. Press SETUP WAVEFORM to display parameters.
3. Press SET CHANNEL and use the encoder wheel to select the channel for which you will define signal parameters.
4. Press SET TYPE/CLASS and define the type of signal activity and set the levels at which that activity must occur in order to generate a trigger.

Figure 59, Wave Trigger

5. Press <<FIELD>> to move among active fields in the lower text area.
6. Press UNITS and use the encoder wheel to select percentage or engineering units.

NOTE **THE WAVEFORM TRIGGER IS AUTOMATICALLY TURNED ON WHEN ANY WAVEFORM IS SELECTED AS A TRIGGER SOURCE.**

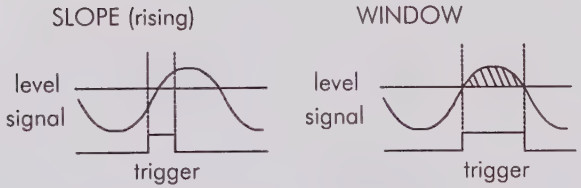


Figure 60, Waveform Trigger

NOTE **UNIT PERCENTAGES ARE SELECTED AS 0.1% INCREMENTS OF THE CHANNEL'S FULL-SCALE RANGE. ENGINEERING UNITS ARE SPECIFIED IN UNITS APPLICABLE TO THE TYPE OF CHANNEL.**

Setting a Clock Trigger

The SETUP CLOCK TRIGGER command is used to establish a trigger to be activated at a set time within a 24-hour period, or at a specific date and time.

[SYS]

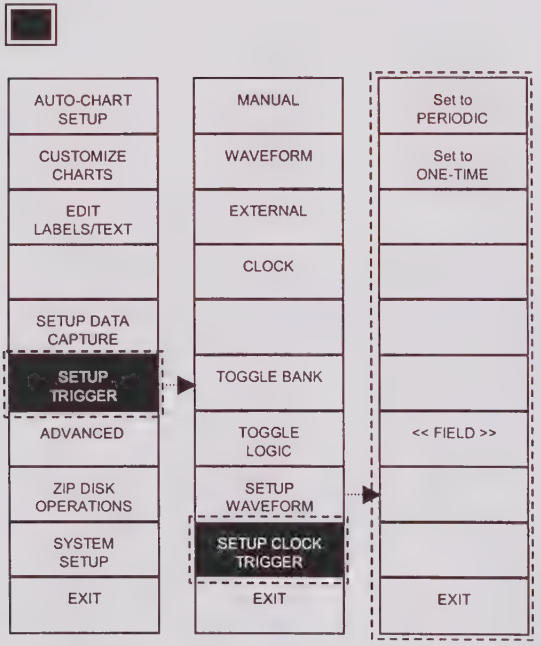


Figure 61, Clock Trigger

TO ESTABLISH A TRIGGER TO BE ACTIVATED AT A SET TIME OR AT A SPECIFIC DATE AND TIME:

1. Press the SYS hotkey, then press the SETUP TRIGGER and SETUP CLOCK TRIGGER softkeys.

2. Press Set to PERIODIC to input a time during the 24-hour period for trigger activation.

   OR

   Press the Set to ONE-TIME to input a specific date and time for trigger activation.

3. Press <<FIELD>> to highlight increments to be defined.

Set an External Trigger Source

Externally generated triggers communicate through the utility I/O port.

[SYS]

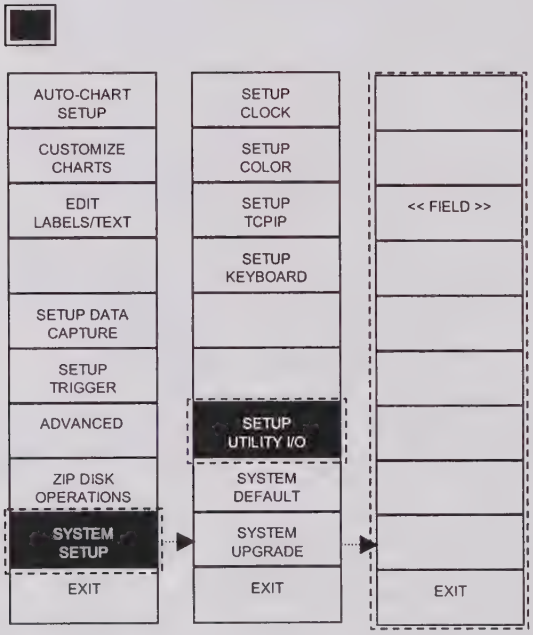


Figure 62, Utility I/O

TO CONFIGURE PIN 13 (CONFIGURABLE INPUT) OF THE UTILITY I/O PORT:

1. Press the SYS hotkey and select the SYSTEM SETUP, SETUP UTILITY I/O softkeys.
2. Select <<FIELD>> to highlight the Util I/O Pin #13 field in the lower text area.
3. Use the encoder wheel to select an option displayed in the lower text area.

TO SET UPS BATTERY MODE:

1. Press SYS and select SYSTEM SETUP, SETUP UTILITY I/O.
2. Select << FIELD >> to highlight the field UPS Battery Mode in the lower text area.
3. Use the encoder wheel to select an option in the lower text area

Arm The System

To begin data capture under the active mode and according to the data capture parameters defined for that mode, you must first arm the system.

How and when data capture records are created and saved is determined by the setup you establish using the SETUP DATA CAPTURE and SETUP TRIGGER menus. Options for arming and triggering are:

Automatically	Choose one of the automatic re-arming options under SET OPERATION in the SETUP DATA CAPTURE menu. The recorder will be armed each time a capture completes.
Manually	Press the front-panel [ARM] key. If the recorder is set up for automatic re-arming, the system will re-arm automatically, immediately upon completion of the previous data capture (or playback if data playback is also set to automatic).
Externally	If you wish to be able to arm the system from an external source, use the Utility I/O port to connect an external source.

Data Capture

In many circumstances, it is desirable to have data captures occur in response to a triggering event. Triggering events can be a user-initiated command, a defined waveform activity, a condition of time, or activity from an external source.

All data capture occurs in the background. Ongoing, active real-time mode is not interrupted and no real-time data is lost. Data capture can occur either during real-time operation or while the recorder is in an idle state.

Four methods of automated data capture (SET OPERATION) are provided to streamline repetitive capture operations:

- single acquisition
- single acquisition with automatic playback
- multiple acquisitions (multi-stacking)
- multiple acquisitions with automatic playback

When used in conjunction with AUTOTRIG, the automated data capture options allow you to tailor activities to a wide range of purposes.

NOTE **TO PERFORM DATA CAPTURE, FIRST SET UP TRIGGER CONDITIONS AND ENABLE TRIGGERS, ARM THE SYSTEM TO RESPOND TO TRIGGERS, SETUP DATA CAPTURE, THEN TRIGGER THE SYSTEM.**

CAUTION **IT IS IMPORTANT THAT THE RECORDER OPERATE ON A RELIABLE POWER SOURCE AT ALL TIMES DURING DATA CAPTURE. IF THE POWER FAILS OR THE RECORDER IS TURNED OFF DURING A DATA CAPTURE, THE ENTIRE DATA CAPTURE COULD BE LOST.**

Set up Data Capture

The SETUP DATA CAPTURE command allows you to establish how data will be captured once specified triggering conditions are met.

[SYS]

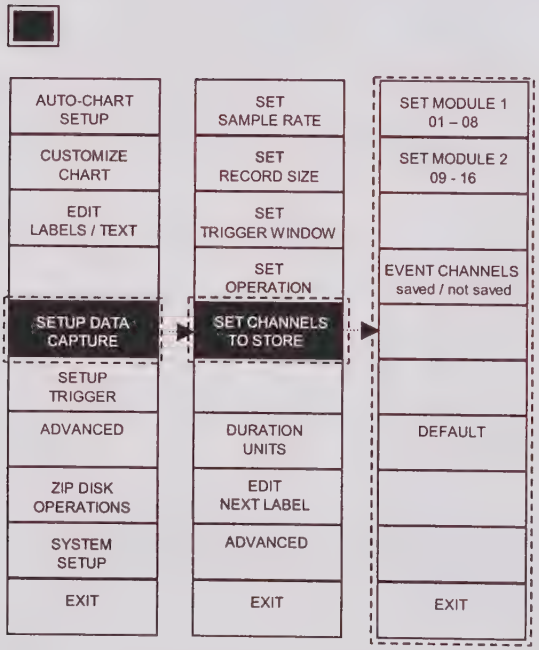


Figure 63, Capture Setup, Channel List

TO SET UP PARAMTERS FOR DATA CAPTURE:

1. Set up trigger conditions and arm the system.
2. Press the SYS hotkey, and the SETUP DATA CAPTURE softkey.
3. Press SET SAMPLE RATE to select from rates per channel in the lower text area using the encoder wheel.
4. Press SET RECORD SIZE and use the encoder wheel to select the size of the next data capture record.
5. Press SET TRIGGER WIN, and use the encoder wheel to define the trigger/window relationship for all records.
6. Press SET OPERATION and use the encoder wheel to select from methods of data capture and playback.
7. Press SET CHANNELS to STORE, SET MODULE… to indicate which channels should be captured and saved. Use the encoder wheel to select specific channels. Press SAVE EVENTS to toggle saving of event data ON/OFF.

8. Press ADVANCED to access disk formatting, backup, export, automatic backup, data review functions, and to specify the first five characters of filenames. Press ADVANCED, AUTOTRIG to toggle triggers ON/OFF.

9. Press DURATION UNITS to set the number of samples captured per channel.

10. Press DURATION UNITS and use the encoder wheel to specify duration of capture.

11. Press EDIT NEXT LABEL to create a label for the next data capture record. If you want to create a text label for a record also, press this softkey, then use the alphanumeric keypad to type the label. Press ACCEPT when finished.

NOTE **THE PARAMETERS DEFINED UNDER SETUP DATA CAPTURE APPLY TO ALL RECORDING CHANNELS.**

Trigger the System

Once armed for data capture, the system will capture data according to the setup you have established.

A data capture is triggered with:

AUTOTRIG turned OFF ..... The system captures data only in response to the criteria established via SETUP TRIGGER settings.

If auto-triggering is turned off and the trigger/window relationship is set to "start," the recorder will wait for a trigger before beginning to capture data. If the trigger/window relationship is set to any other setting, the recorder will capture pre-trigger data in the specified amount. When the pre-trigger amount of data has been stored, the oldest sample is replaced by the most recent, creating a circular buffer. This continues until a valid trigger is detected and the post-trigger phase begins. In the post-trigger phase, data is acquired and stored until the user-specified amount of samples is collected.

AUTOTRIG turned ON..... The system will create a data record upon the system being armed. All records will save only post-trigger data. With the AUTOTRIG option on, the moment of arming acts as a trigger.

Data Review, Playback, and Reporting

Data Review and Playback

The DATA RECORD REVIEW menu is used to replay captured data for examination and analysis. It provides playback controls that allow you to:

- locate a record on the drive
- preview a selected record on the display (without the need to print to paper)
- adjust settings for playback to paper
- playback to paper
- edit the label attached to the active record
- perform Fast Fourier Transform on the record

NOTE **WHEN YOU BRING UP A RECORD FOR REVIEW, NOMINAL COMPRESSION IS APPLIED AUTOMATICALLY TO THE DATA TO PRESENT AS MUCH OF THE RECORD ON THE DISPLAY AS POSSIBLE.**

LARGE COMPRESSION FACTORS WILL RESULT IN SLOWER DISPLAY UPDATES.

Review Record from Zip

[MODE]

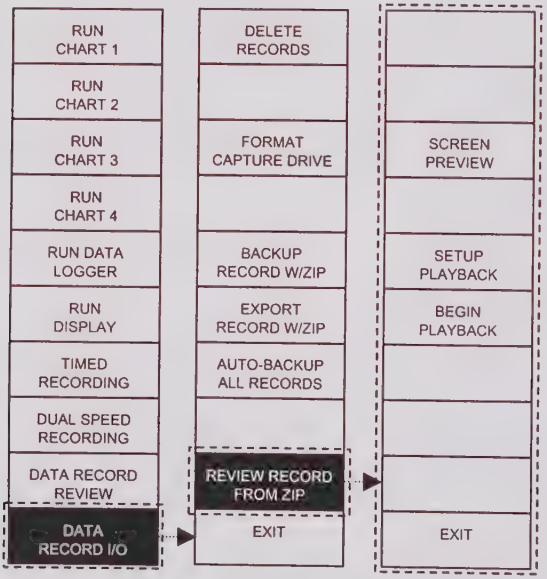


Figure 64, Record I/O

TO REVIEW A STORED RECORD:

1. Press the MODE hotkey, then select the DATA RECORD I/O softkey.
2. Press REVIEW RECORD FROM ZIP.
3. Use the encoder wheel to select a record, or use the keypad to specify a filename.
4. Press SCREEN PREVIEW to perform FFT Analysis.
5. Press SETUP PLAYBACK to specify playback parameters.
6. Press BEGIN PLAYBACK to start record playback.

Find a Record

Searches can be performed on partial date and time information. Entry of HH, MM, and SS is not required.

[MODE]

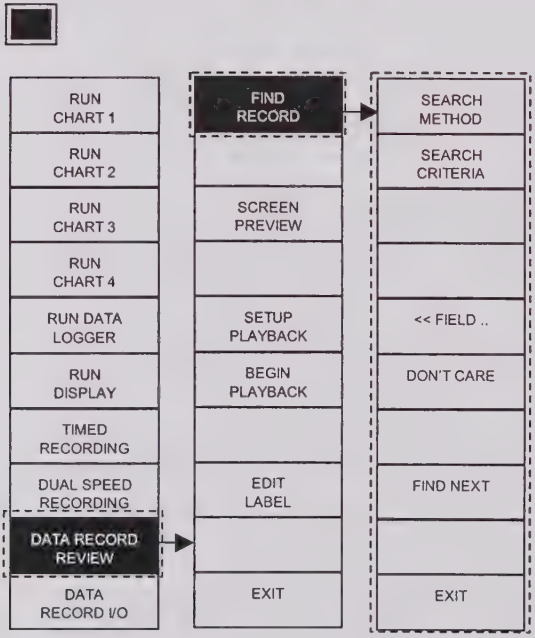


Figure 65, Find Record

TO FIND A RECORD:

1. Press the MODE hotkey, then select the DATA RECORD REVIEW softkey. Press FIND RECORD.
2. Press SEARCH METHOD and select from record label, number, time and date using the encoder wheel.
3. Press SEARCH CRITERIA to narrow search parameters based on the METHOD you have already defined. To use wildcards (search all), press DON'T CARE.
4. Press FIND NEXT to execute the search.
5. Press [RUN/HALT] to display the record.

NOTE **A RECORD'S TIME IS ITS TIME STAMP. A RECORD'S TIME STAMP IS DEFINED AS: (1.) IF A TRIGGER OCCURRED, THE TRIGGER POINT. (2.) IF NO TRIGGER OCCURRED, THE POINT AT WHICH THE CAPTURE ENDED.**

Preview a Record

SCREEN PREVIEW allows detailed review of any data record in different chart formats. Zoom in on selected screens for review, printing, or save them to disk.

[MODE]

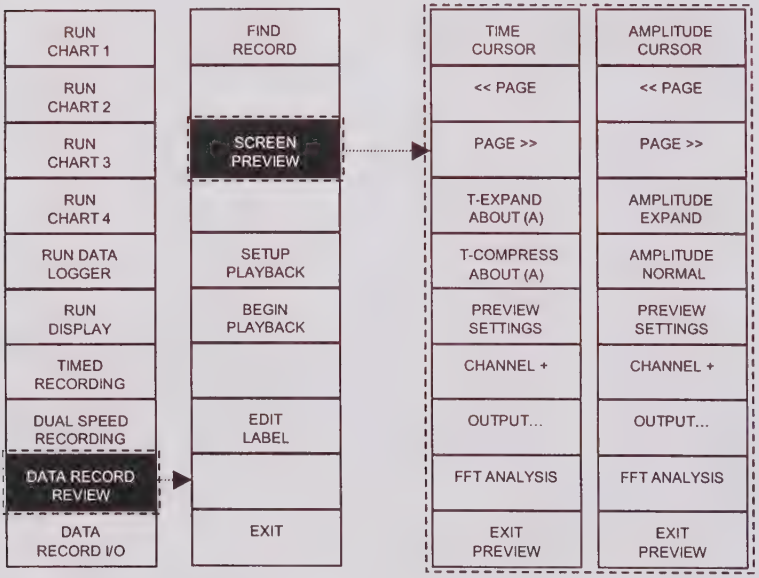


Figure 66, Screen Preview

TO PREVIEW A RECORD:

1. Locate a record to review using FIND RECORD.

2. Press the MODE hotkey, then select the DATA RECORD REVIEW and SCREEN PREVIEW softkeys.

3. Use the << PAGE >> softkeys to move to the portion of the record you wish to measure.

4. Press TIME or AMPLITUDE CURSOR to select one or more cursors. An arrow will appear at the top, bottom, or sides of the selected cursor(s). Use the encoder wheel to move cursors within the record.

5. When TIME CURSOR is chosen, the record's time base can be expanded or compressed around cursor A using T-EXPAND or T-COMPRESS. The lower text area will indicate which channel is being measured, the compression rate, and related time measurement information.

6. When AMPLITUDE CURSOR is chosen, press AMPLITUDE EXPAND to expand the section between the horizontal cursors. Press AMPLITUDE NORMAL to return the display to normal.

7. To view output options, including printing the screen to paper or saving it to Zip disk, press the OUTPUT key and make a selection.

8. To select a different channel for measurement, use the CHANNEL+ or CHANNEL – key to scroll through available channels.

9. Press PREVIEW SETTINGS to access advanced PREVIEW features. Press FFT ANALYSIS to access the FFT ANALYSIS menu.

Preview Settings

The advanced preview features provided in the PREVIEW SETTINGS menu allow you to view the record in any one of four stored chart formats, in samples (points), or in time; to determine the portion of the record being displayed; to go directly to the trigger point; or to show the entire record on one screen.

[MODE]

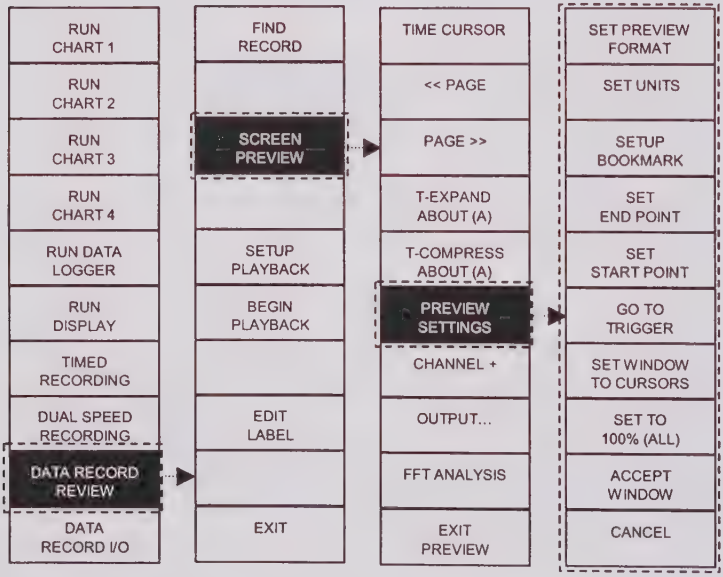


Figure 67, Advanced Preview Features

TO SELECT A CHART FORMAT FOR PREVIEWING:

1. Press the MODE hotkey, then press the DATA RECORD REVIEW, SCREEN PREVIEW, and PREVIEW SETTINGS softkeys.

2. Press SET PREVIEW FORMAT to toggle the chart layout in the lower text area.

TO DISPLAY RECORDS IN SAMPLES (PT) OR TIME:

1. Press the MODE hotkey, then press the DATA RECORD REVIEW, SCREEN PREVIEW, and PREVIEW SETTINGS softkeys.

2. Press SET UNITS to toggle the value.

3. Press SET START POINT / SET END POINT and use the encoder wheel or keypad to define the starting and end samples of the display.

TO LOCATE THE TRIGGER WITHIN A RECORD:

1. Press the MODE hotkey, then press the DATA RECORD REVIEW, SCREEN PREVIEW, and PREVIEW SETTINGS softkeys.

2. Press GO TO TRIGGER. If a trigger is present, it will be indicated by a dashed line.

TO EXPAND OR COMPRESS THE VIEWING AREA:

1. Press the MODE hotkey, then press the DATA RECORD REVIEW and SCREEN PREVIEW softkeys.

2. Use T-EXPAND or T-COMPRESS to compress or expand the view. The lower text area will indicate which channel is being measured, the compression rate, and related time measurement information.

3. When the record is compressed significantly, press PREVIEW SETTINGS, then press SET WINDOW TO CURSORS to view a small region of the record.

4. Press SET TO 100% (ALL) to show the entire record on one screen display.

TO SET A BOOKMARK:

A bookmark, or reference point, (noted as X) can be set on a data record using the SCREEN PREVIEW menu. Once set, the bookmark is saved as a part of the record for later use and recall.

Bookmarks are handy for setting a look-up point during initial review, returning precisely to an area of interest, attaching notes about this particular point (sample interval) in the record, referring to from another page within the same record, or for using as a reference point (on another page) which can be used in combination with the A cursor.

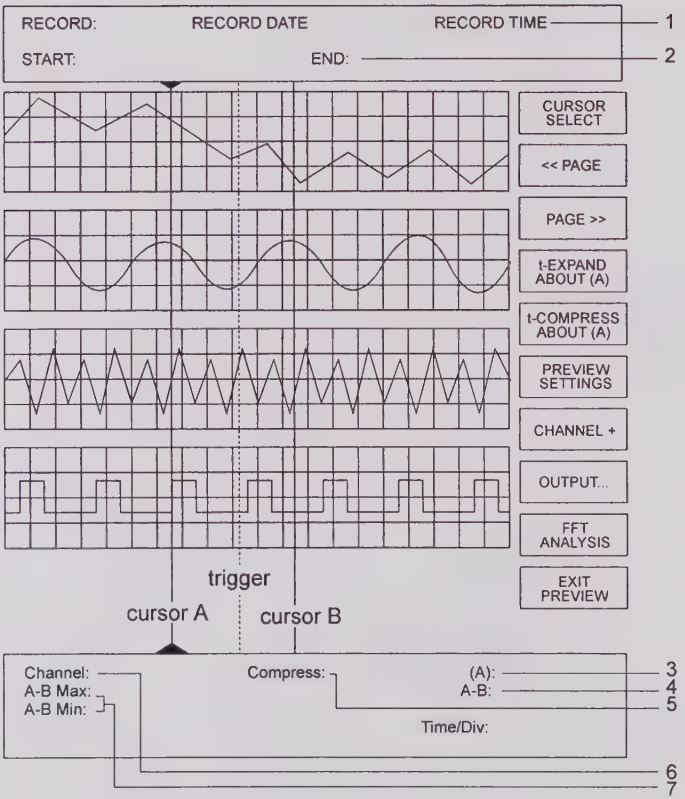
1. Press the MODE hotkey, then press the DATA RECORD REVIEW, SCREEN PREVIEW, and PREVIEW SETTINGS softkeys.

2. Press SETUP BOOKMARK, and toggle the BOOKMARK STATE softkey to ON.

3. To delimit the viewing area to fit on one page, press SET WINDOW, BOOKMARK to A.

NOTE **THE WORD "PREVIEW" IMPLIES REVIEW OF A RECORD ON THE DISPLAY ONLY, "PLAYBACK" IMPLIES PRINTING TO PAPER.**

NOTE **WHEN YOU BRING UP A RECORD FOR REVIEW, NOMINAL COMPRESSION IS APPLIED AUTOMATICALLY TO THE DATA TO PRESENT AS MUCH OF THE RECORD ON THE DISPLAY AS POSSIBLE.**



y = amplitude
T = time
(t) = trigger
pt = sample pts

Figure 68, Screen Preview Display

1 number, date, time of record being recorded
2 start/end of the portion of the record currently on the monitor
3 time measurement at selected cursor
4 time measurement between cursor A and cursor B
5 rate of compression being applied to the record being measured
6 channel being measured
7 amplitude measurement (min and max) between cursors A and B

Set up Fast Fourier Transform (FFT)

[MODE]

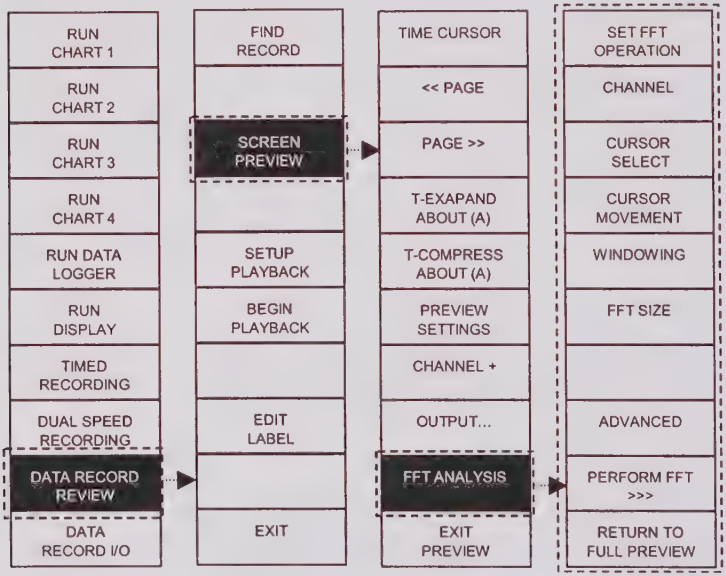


Figure 69, FFT Analysis

TO SET UP FOR CONVERTING DATA FROM THE TIME DOMAIN INTO THE FREQUENCY DOMAIN:

1. Press the MODE hotkey, then press the DATA RECORD REVIEW and SCREEN PREVIEW softkeys. Use SCREEN PREVIEW options to view the area of interest.

2. Once all PREVIEW options have been performed to narrow the viewing area, press FFT ANALYSIS to access set up options for performing FFT.

3. Press SET FFT OPERATION to select a Transform Operation from the options available in the lower text area.

4. Press the CHANNEL softkey and use the encoder wheel to select a channel.

5. The CURSOR SELECT softkey may not be visible, depending on the operation chosen. If visible, press CURSOR SELECT to access cursors independently and use the encoder wheel to narrow the data area. Center the time area within the display for best results. A reference point may also be used to center data display.

6. Perform windowing after data is reduced to meet the size requirements of the algorithm. This includes up front input averaging and any required interpolation of the signal. The WINDOWING softkey may not be visible, depending on the operation chosen. Press WINDOWING and use the encoder wheel to select among windowing options available based on the operation method selected. The FFT window area to be used in FFT should be completely shown on the screen unless Reference N Size mode is used.

   The examples shown are applied to a full scale square waveform signal input:

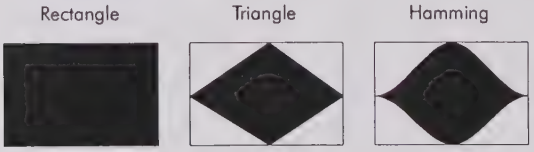


Figure 70, FFT Windowing Processes

7. Press FFTSIZE, and use the encoder wheel to select from available options.

8. To define plot analysis type, press ADVANCED and set Y-AUTOSCALE to ON/OFF, or toggle Y-T plot ON/OFF. Press EXIT.

NOTE **OPTIONAL FFT ANALYSIS AND WINDOW SETUPS MUST BE INVOKED OR INITIATED WHILE IN A NON-EXPANDED SCREEN PREVIEW WINDOW.**

NOTE **ADVANCED FFT SUPPORT IS FOUND UNDER DATA RECORD REVIEW AND PREVIEW SUPPORT. ADVANCED SUPPORT IS AN ADDED UTILITY TO BE USED AS-NEEDED TO FIT THE APPLICATION.**

Optimize FFT Analysis Timing

Following is a summary of the factors that impact analysis timing. Optimize timing based on the requirements of the FFT process being performed.

- Select a predictable amount of raw data for FFT process from the data record by careful use of variables including cursors, compression in use, and method of selection. Selecting a heavily compressed window for FFT will result in slower timing and can degrade results, since extensive averaging will occur during processing.
- If selectable, use the smallest FFTSize possible for processing. As is the case with DFT processing, processing larger sizes increases timing dramatically.
- Interpolation is required when cursor window is not power-of-2, which often is the case in variable cursor mode. Interpolation adds a negligible amount of time to FFT processing.
- Any windowing selected (non-rectangle) causes the signal to be multiplied by another function prior to FFT and adds a negligible amount of time to FFT analysis timing.
- Any secondary plot, such as the Y-T plot combined with FFT will also take time to process. This time is generally a negligible amount.

Perform FFT Transform

The PERFORM FFT function performs the transform into complex data. The results can then be seen in various forms without performing FFT again. Returning to FFT ANALYSIS for setup should not be necessary.

TO CONVERT DATA FROM TIME TO FREQUENCY:

1. First, set up options for Fast Fourier Transform.
2. Press PERFORM FFT >>. The display will include full results shown in one screen (compressed as-needed).

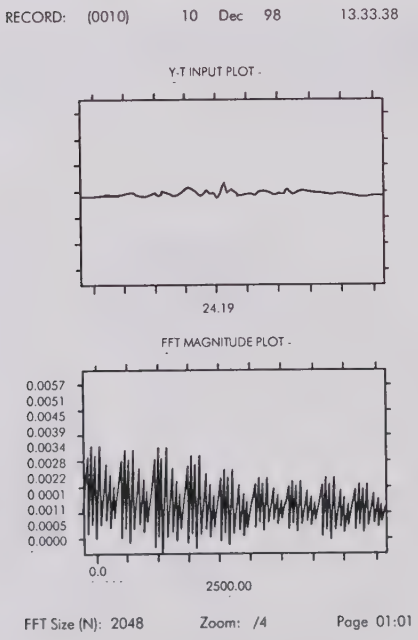


Figure 71, Perform FFT Result

Analysis results are displayed as a magnitude plot of the polar form. Results of the transform are the positive frequencies through the Nyquist frequency, unless the EXPAND+ feature is active, in which case, it will be a subset.

Place the cursor on a resulting plot for measurement reference. As the cursor is moved across a plot, corresponding magnitude and frequency measurements will be shown. This is useful for quickly viewing peak readings.

Statistics applicable to the FFT are also shown on the display and in some cases are computed in connection with the cursor.

If FFT output reflects a compression factor of >1, greater FFT frequency resolution can be obtained by expanding the FFT output plot up to a 1:1 ratio.

FFT Data Comparison

The Y-T data plot is a visual plot of the data selected for FFT which can be added to FFT output and displayed on the same screen. It represents the raw data before FFT processing.

NOTE **SINCE THIS IS A FULL AND COMPREHENSIVE WINDOW, IT MAY BE VERY COMPRESSED AND NOT ALLOW MUCH SIGNAL DIFFERENTIATION. THEREFORE, STATISTICS AND MEASUREMENTS SHOULD BE GATHERED USING SCREEN PREVIEW.**

NOTE **TO AVOID CONFUSION BETWEEN TWO PLOTS WITH ONE CURSOR SET, CURSOR AND PLOT EXPANSION CONTROLS ARE UNAVAILABLE WHEN THE Y-T DATA PLOT IS ALSO DISPLAYED.**

Playback to Paper

Use SETUP PLAYBACK to expand or compress a data-capture record, playback along the time axis, select a chart format for playback (printing), or to turn on the print header. Review can be centered around a trigger point or based on the capture window as a percentage. These options are most useful in automated or unattended operation. Settings for manual selection of the playback window are record-dependent and adjustable.

[MODE]

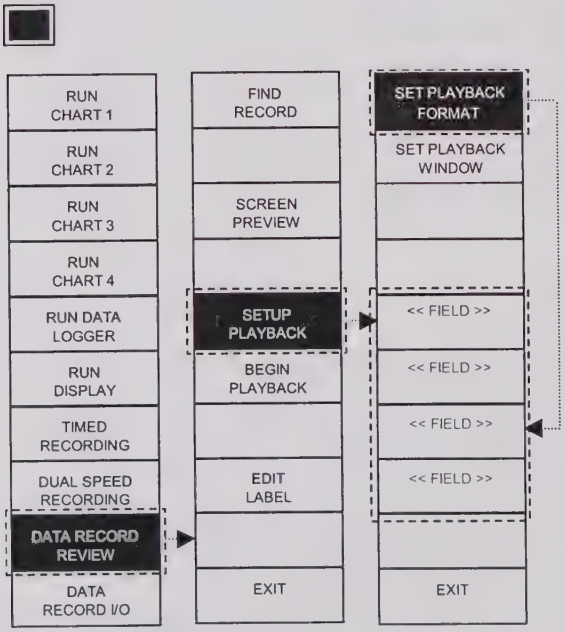
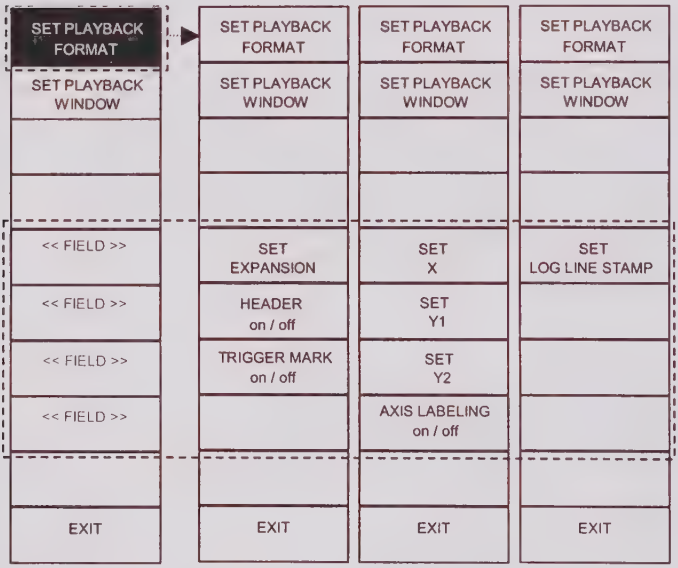


Figure 72, Output Setup

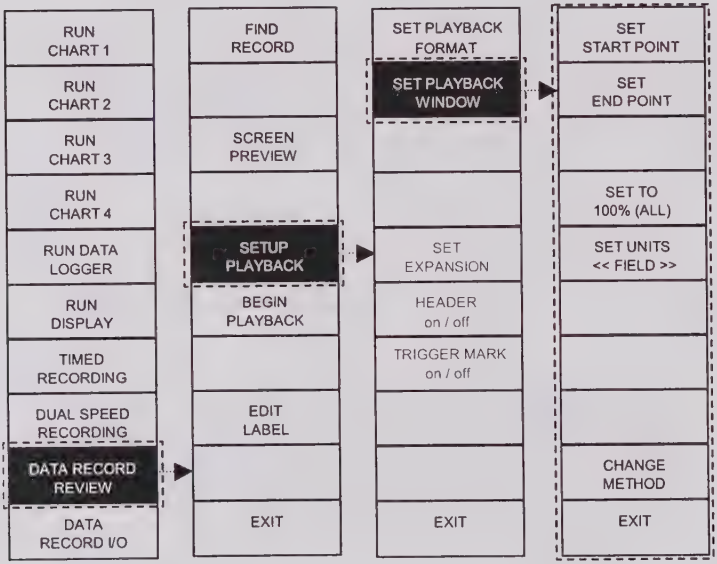


TO SELECT A CHART FORMAT FOR PLAYBACK (PRINTING):

1. Press the MODE hotkey, then select the SETUP PLAYBACK softkey.
2. Press SET OUTPUT FORMAT to select from available charts and chart formats using the encoder wheel and the <<FIELD>> softkey.

TO EXPAND/COMPRESS A DATA-CAPTURE RECORD OR TO TURN ON THE PRINT HEADER:

1. Press the MODE hotkey, then select the SETUP PLAYBACK softkey.
2. Press MODIFY SETTINGS and use the encoder wheel and <<FIELD>> key to select a t-expansion value and to turn the print header on/off.



TO SET START AND END SAMPLE POINTS OF PLAYBACK (PRINTING).

1. Press the MODE hotkey, then select the DATA RECORD REVIEW, SETUP PLAYBACK, and SET WINDOW softkeys.
2. Press SET START POINT/SET END POINT and use the encoder wheel or keypad to define the starting an end samples of the display.
3. Press SET TO 100% (ALL) to show the entire record on one screen display.
4. Press TOGGLE UNITS to set the record to be displayed in samples (pt) or units.
5. Press CHANGE METHOD to select a method of review.

TO PLAYBACK ALONG THE TIME AXIS:

1. Press BEGIN PLAYBACK to activate playback to paper.

Display in Real-time

A live display provides real-time presentation of waveform data simultaneous with the paper recording for waveforms or events. The time base of the display is synchronized proportionally with the time base and chart speed of the recorder.

The display may also be frozen to allow the taking of time and signal measurements using the cursors.

If desired, waveform color can be set to change automatically when a signal exceeds defined limits.

NOTE **AS THE DISPLAY SCROLLS BY, IT DOES NOT AUTOMATICALLY CLEAR WHEN SPEED CHANGES ARE INITIATED. IT IS POSSIBLE THEREFORE, THAT THE DISPLAY WILL ACCUMULATE MULTIPLE TIME BASES AND AMPLIFIER SETTINGS ON ONE SCREEN.**

Label Records

The EDIT LABEL command is used to make changes to record label, even after the record is captured.

[MODE]

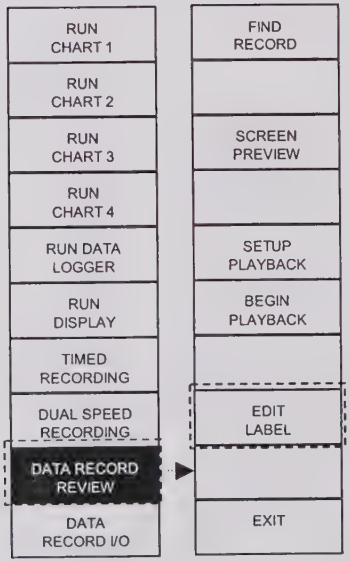


Figure 73, Data Review

If no label is defined, a default label is automatically assigned to the record. The default label is the date/time of record capture in MONDDYYMMSS format: i.e. JAN01991103.

TO ASSIGN A RECORD LABEL:

1. Press the MODE hotkey, then select the DATA RECORD REVIEW softkey.
2. Press EDIT LABEL and enter a new label for the record using the alphanumeric keypad.
3. Press ACCEPT to activate the change.

NOTE **THE LABEL ASSIGNED TO A RECORD CAN BE USED AS A SEARCH TOOL WHEN FINDING A RECORD.**

Print Information/Status Reports

[HELP]

Figure 74, Print Reports

TO PRINT INFORMATION/STATUS REPORTS:

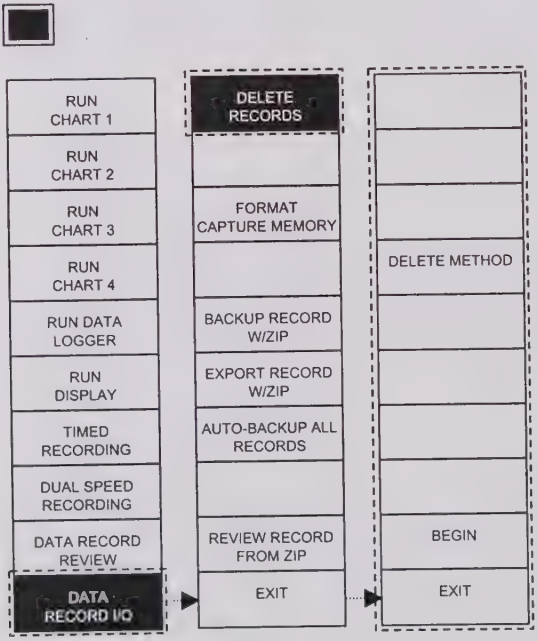
1. Press the HELP hotkey and select one of the PRINT REPORT softkeys.

Data Record I/O

Delete Records

The DELETE RECORDS command is used to delete one or more records stored on the recorder's drive. The DELETE RECORDS command does not defragment the disk.

[MODE]



TO DELETE ONE OR MORE RECORDS:

1. Press the [MODE] hotkey, then press the DATA RECORD I/O and DELETE RECORDS softkeys.

2. Use the encoder wheel to select record(s) to be deleted. Press BEGIN. To learn the number of the last record, turn the encoder wheel to the right until the highest record number (last record) is listed. After records are deleted, the record number of each existing record will remain unchanged.

3. Press EXIT to leave the menu without deleting records.

Figure 75, Delete Records

CAUTION **IT IS IMPORTANT THAT THE RECORDER OPERATE ON A RELIABLE POWER SOURCE AT ALL TIMES WHEN DELETING**

RECORDS. IF THE POWER FAILS OR THE RECORDER IS TURNED OFF DURING THIS FUNCTION, A RECORD(S) COULD BECOME INACCESSIBLE.

NOTE **IF, DURING INITIALIZATION OR OPERATION, THE RECORDER DETECTS CORRUPTED DATA ON THE DRIVE, A "RECORD ACCESS ERROR" MESSAGE WILL APPEAR IN THE RECORD DESCRIPTION OR RECORD INVENTORY. THIS MESSAGE INDICATES THAT ONE OR MORE DATA CAPTURE RECORDS HAVE BEEN CORRUPTED DUE TO ONE OF THE FOLLOWING:**

- **POWER LOSS BEFORE COMPLETION OF A PURGE OR DELETE ACTION**

- **POWER LOSS DURING THE CONCLUDING STAGE OF A DATA CAPTURE**

THE CORRUPTED RECORD(S) ARE NO LONGER ACCESSIBLE. TO REMOVE A CORRUPTED RECORD(S), SIMPLY LOCATE THE RECORD(S) AND USE THE DELETE RECORDS COMMANDTO REMOVE IT AND ITS ALLOCATED STORAGE SPACE FROM THE DRIVE.

Format Capture Memory

FORMAT CAPTURE MEMORY is used to free the recorder's memory. To reformat a Zip disk, use the ZIP DISK OPERATIONS menu, FORMAT DISK command.

CAUTION THIS COMMAND WILL ERASE ALL STORED DATA.

[MODE]

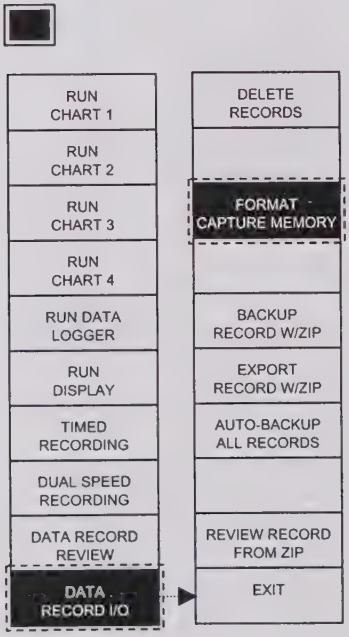


Figure 76, Record I/O

TO FORMAT CAPTURE MEMORY:

1. Press the MODE hotkey, then select the DATA RECORD I/O and FORMAT CAPTURE DRIVE softkeys.
2. To begin reformatting, press BEGIN. An "Are you sure . . . verify?" prompt will appear.
3. To cancel the command, press EXIT.

Backup and Export Records

BACKUP RECORD W/ZIP is used to provide binary backup of the internal data capture record to a Zip disk. It is also a convenient way to port records to a PC.

Astro-Med supplies AstroVIEW™ C software to streamline review of archived files. Records are stored as .dcr (data capture record) files.

Figure 77, .dcr Record Format

EXPORT RECORD W/ZIP is used to export measurement and record information in a portable text format (ASCII) to a Zip disk. Exported records can be viewed with an editor or can be imported into Microsoft Excel or similar software.

Exported files are saved in .csv (comma-separated variable) file format.

Figure 78, .csv Record Format

[MODE]

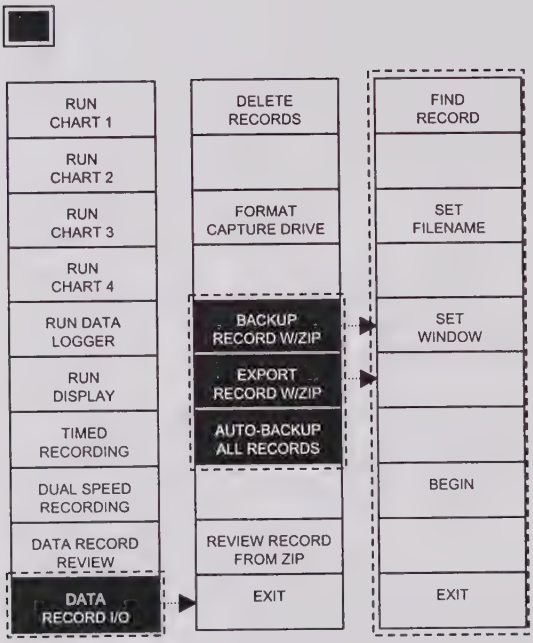


Figure 79, Backup / Export Record

TO BACKUP ALL RECORDS:

1. Press the [MODE] hotkey, then select the DATA RECORD I/O softkey.
2. Press AUTO-BACKUP ALL RECORDS. Records will be automatically stored in sequence.

TO BACKUP OR TO EXPORT A RECORD:

1. Press the [MODE] hotkey, then select the DATA RECORD I/O and BACKUP RECORD W/ZIP or EXPORT RECORD W/ZIP softkeys.
2. To locate the record you wish to backup, use the FIND RECORD command.
3. To specify a record filename, press SET FILENAME and use the keypad to enter a filename.
4. To specify a portion of the file, press SET WINDOW and use the encoder wheel to set START and END points, or select SET TO 100% to backup or export the entire record.
5. To activate BACKUP or EXPORT, press BEGIN.

Zip Disk Operations

WARNING **IOMEGA CORPORATION STRONGLY RECOMMENDS THE ZIP DRIVE BE HORIZONTAL AND RIGHT-SIDE-UP WHEN IN USE.**

Figure 80, Correct Way to Orient the Internal Zip Drive

NOTE **FILES STORED ON ZIP ARE SUBJECT TO DOS FILE FORMAT CONVENTIONS. UP TO EIGHT CHARACTERS, PLUS A THREE-CHARACTER FILE EXTENSION.**

NOTE **THE RECORDER SUPPORTS ONE ACTIVE ZIP DRIVE PARTITION – THE ONE CURRENTLY SET AS ACTIVE. SUB-DIRECTORY SUPPORT IS NOT PROVIDED.**

NOTE **READ/WRITE PROTECTION OF DATA ON THE ZIP DISK IS NOT SUPPORTED, HOWEVER, DETECTION OF WRITE-PROTECT SETTINGS APPLIED BY THE ZIP TOOLS PROGRAM AVAILABLE FROM IOMEGA CORPORATION IS SUPPORTED.**

NOTE **OPTIMUM PERFORMANCE OCCURS WITH A FRESHLY FORMATTED DISK.**

NOTE **FOR MAINTENANCE AND TECHNICAL INFORMATION RELATED TO YOUR ZIP DISK, REFER TO THE DOCUMENTATION PROVIDED BY IOMEGA CORPORATION.**

Save or Recall Recording Setups

[SYS]

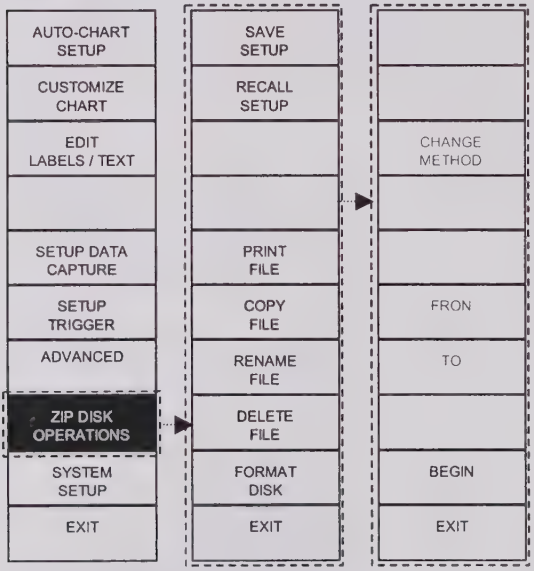


Figure 81, Zip Disk I/O

The SAVE SETUP command is used to save real-time recording setups, including those specified in AstroSET.

The RECALL SETUP command is used to recall settings from AstroSET that were saved on the Zip disk previously.

TO SAVE OR RECALL SETTINGS FROM ZIP:

1. Press the SYS hotkey, then select the ZIP DISK OPERATIONS and SAVE SETUP, or RECALL SETUP softkey.

2. Use the keypad to name the file. Press BEGIN to activate. Present recorder settings are immediately overridden and replaced with stored settings.

Print ASCII Text Files

PRINT FILE is used to print an ASCII text file to paper.

[SYS]

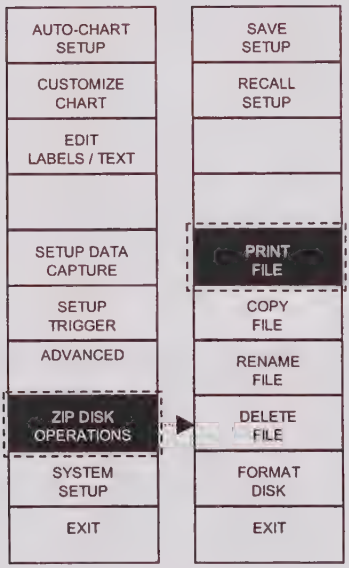


Figure 82, Zip Disk I/O, Print File

The PRINT FILE command provides a convenient way to store and print test instructions. Simply create text on your PC with any text editor. Then save the file on a Zip disk and print it to chart paper using the PRINT FILE command.

TO PRINT A TEXT FILE TO CHART PAPER:

1. Press the SYS hotkey, then select ZIP DISK OPERATIONS and PRINT FILE.
2. Use the encoder wheel or keypad to select a file to print.
3. Press BEGIN to activate command.

Copy, Rename, or Delete Data Files

COPY FILE is used to make a copy of a file on a Zip disk.

RENAME FILE is used to rename a file stored on the Zip disk.

DELETE FILE is used to delete a file stored on the Zip disk.

[SYS]

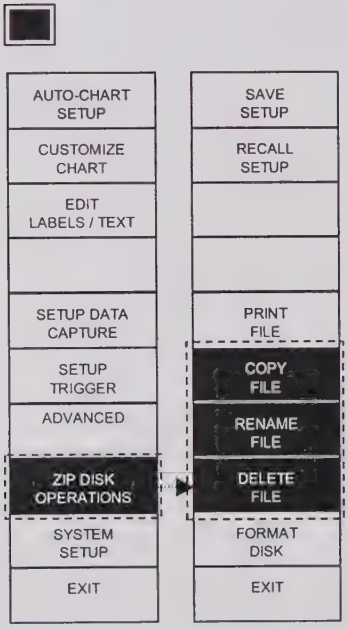


Figure 83, Zip Disk I/O, Copy/Rename/Delete

TO COPY, RENAME, OR DELETE A FILE:

1. Press the SYS hotkey, then select the ZIP DISK OPERATIONS softkey.
2. Press COPY FILE, RENAME FILE, or DELETE FILE and use the encoder wheel or keypad to select a file to copy, rename, or delete.

Format a Zip Disk

The FORMAT DISK command is used to format a Zip disk.

[SYS]

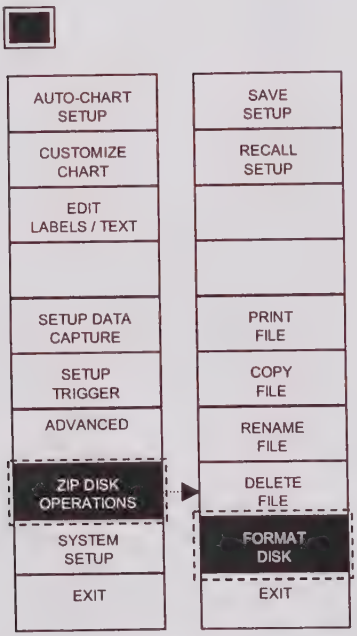


Figure 84, Zip Disk I/O, Format Disk

TO FORMAT A ZIP DISK:

1. Insert a Zip disk in the drive.
2. Press the SYS hotkey, then select the ZIP DISK OPERATIONS softkey.
3. Press FORMAT DISK. All data on the disk will be erased and the disk will be reformatted.

Using a PC with the Recorder

PC Interface

Connection is provided through a built-in Ethernet™ connector, located on the right-side panel of the recorder. PC connection is provided to simplify remote access to data records.

Astro-Med provides two Windows-based utility programs for use with your recorder: AstroSET™ and AstroView™ C.

AstroVIEW™ C

AstroVIEW C is used for viewing and manipulating data capture record files (.dcr's) generated by your recorder.

With AstroVIEW C, you can review acquired waveforms, make measurements, and save portions of the data in ASCII format for use by other applications. It is designed to run under Windows 95 and Windows NT as a true 32-bit application.

Release 1.4 supports data upload from the following Astro-Med instruments:

ETHERNET UPLOAD CAPABILITY	SCSI UPLOAD CAPABILITY	CLUSTER CAPTURES	MANUAL UPLOAD (SNEAKERNET)
Dash 4u	Dash 4u	AstroDAQ	Dash 2 (Floppy)
Dash 8n	Dash 8n	AstroDAQ 2	Dash 4u (Zip)
Dash 8u	Dash 8u		Dash 8n (Zip)
Dash 16u	MT95K2		Dash 8u (Zip)
			Dash 10 (Floppy)
			Dash 16u (Zip)
			MT95K2 (Floppy)

Installing AstroVIEW C

AstroVIEW C runs in either the Window 95 or Windows NT environment.

TO INSTALL ASTROVIEW C:

1. Insert the installation disk supplied by Astro-Med, Inc. into PC's floppy drive. Run Setup.exe and follow the on-screen instructions.

2. Select a destination directory for the program. AstroVIEW C will be installed to the directory you select.

3. Launch AstroVIEW now or run the **AstroVIEW.exe** file later.

AstroVIEW offers ample online help to simplify the process of specifying recorder settings. Refer to the AstroVIEW C online help for assistance using the program.

Uploading to PC via Ethernet

Prior to successful upload, an Ethernet adapter and the Windows TCP/IP stack must be properly configured. For detailed instructions, consult your network Systems Administrator.

TO UPLOAD FROM THE RECORDER TO A PC VIA ETHERNET:

1. Select **Upload Utilities, Ethernet upload - Dash 16u...** from the AstroVIEW C Main Menu.

2. Specify the **IP address of the recorder** from which you wish to retrieve data record files.

3. Connection will occur.

4. Click to **select the record** you want to upload. Ctrl-click to select multiple records. Record information applicable to individually-selected records will be shown. Selecting multiple records will cause the record information section to disappear. To select a block of records, click on the first record, then hold down Shift and click on the last record. All the records between them will be selected.

5. Select **Upload** to begin the transfer process. Type in a **filename**. Long filenames are supported locally to AstroVIEW C, but short filenames (8.3 format, eight characters or less) should be used if the file will be moved manually back to the recorder. If you are uploading multiple records, the new file names will have an index attached (e.g. name1.dcr, name192.dcr ...).

6. Select **Close** when complete.

AstroSET

Once you are familiar with recorder operations, AstroSET provides a convenient way to specify modes of operation.

AstroSET is an offline setup utility for your Astro-Med, Inc. portable field recorder. It enables you to specify the following parameters using a PC, rather than setting them from the recorder itself:

- zero and gain
- data capture
- chart setup
- text setup
- display setup
- trigger setup
- miscellaneous

Using an Ethernet connection, setting files can be uploaded/downloaded seamlessly, settings can also be saved to Zip disk and transferred.

Installing AstroSET

AstroSET is a Windows-based utility program that must be installed on a PC running either the Window 95 or Windows NT operating system.

TO INSTALL ASTROSET:

1. Insert the installation disk into the floppy drive on your PC. Run Setup.exe and follow the on-screen instructions.

2. Select a destination directory for the program. AstroSET will be installed to the directory you select.

3. Launch AstroSET now or run the **AstroSET.exe** file later.

AstroSET provides online help to simplify the process of specifying recorder settings. Refer to the AstroSET online help for assistance using the program.

Chapter 4
Maintenance

Load Z-Fold Thermal Paper

Astro-Med, Inc. chart paper is manufactured by Astro-Med, Inc. to exacting standards that reduce residue build-up on and abrasion of thermal print heads. For best results, and to ensure that the print head warranty remains valid, always use Astro-Med, Inc. or Astro-Med, Inc. approved chart paper.

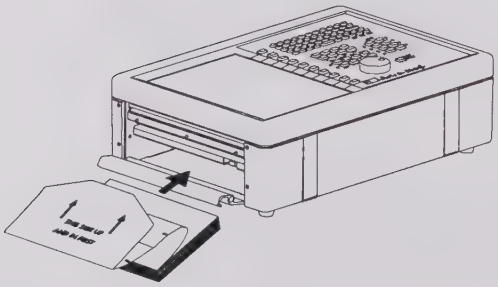


Figure 86, Loading Paper, Step 1

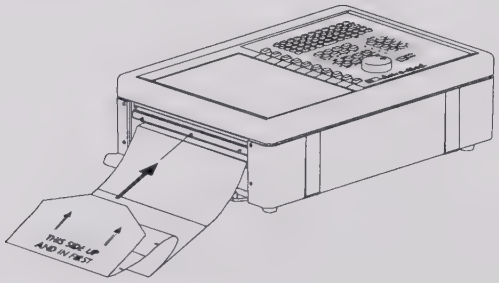


Figure 87, Loading Paper, Step 2

TO LOAD CHART PAPER:

1. Be sure to discard the cardboard at the top and bottom of the paper pack. Position the top sheet (labeled "THIS SIDE UP AND IN FIRST") with the arrows pointing toward the paper chamber.

2. Lift up the top sheet and a short leader of the paper. Place the paper pack inside the paper chamber, keeping the top sheet and leader outside the door.

3. Feed the top sheet into the opening immediately below the black bar (beneath the drive roller).

4. Carefully push the paper through the channel until the paper exits above the drive roller.

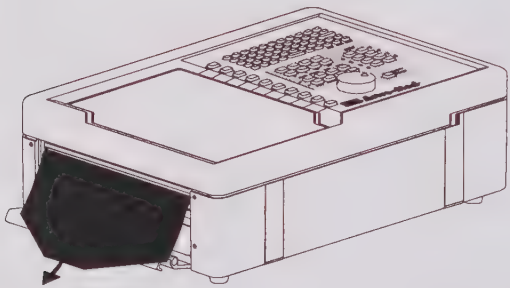


Figure 88, Loading Paper, Step 3

NOTE **IF A PAPER OUT MESSAGE IS DISPLAYED IN THE LOWER TEXT AREA AFTER PERFORMING THIS PROCEDURE: 1) ENSURE THE PAPER IS LOADED PROPERLY; 2) MAKE CERTAIN A SUFFICIENT LENGTH OF PAPER IS EXITING THE CHUTE.**

WARNING **IF THE ERROR PERSISTS, THE INTERLOCK DETECTOR MAY BE OUT OF ADJUSTMENT. VERIFYING CALIBRATION OF THE INTERLOCK DETECTOR, AND ALL SERVICE PROCEDURES, SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY. CONTACT ASTRO-MED FOR SERVICE.**

Cleaning the Printhead

For optimum performance, print elements must be kept free of any debris or residue build-up.

NOTE **REGULAR CLEANING WILL NOT HARM THE PRINTHEAD. AT A MINIMUM, CLEAN THE PRINTHEAD WITH ALCOHOL AND A SOFT COTTON CLOTH EVERY TEN HOURS OF OPERATION.**

TO CLEAN THE PRINTHEAD:

1. Turn off power to the printer.
2. Locate the drive roller and the printhead. The printhead is located directly behind the static brush and above the drive roller.
3. Put your fingers under the bar that runs above the printhead (above where the paper exits) and lift the bar up to expose more of the printhead area.
4. Run a swab or soft cloth dipped in alcohol down the length of the crest of the drive roller (between the drive roller and the printhead). Wipe off any excess.

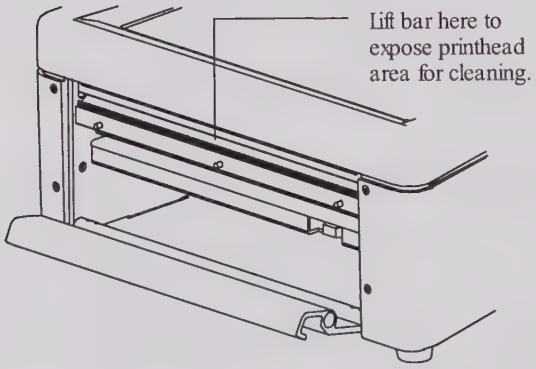


Figure 89, Printhead Area

Upgrade System Software

Contact Astro-Med, Inc. to acquire software upgrades.

WARNING **IF YOU DO NOT SAVE THE ACTIVE RECORDER SETUP, IT WILL BE LOST DURING THE UPGRADE PROCEDURE AND WILL NOT BE RECOVERABLE. SAVE THE ACTIVE RECORDER SETUP TO DISK PRIOR TO UPGRADE.**

[SYS]

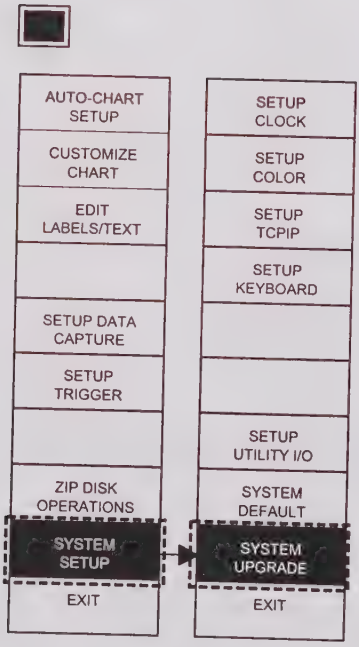


Figure 90, Upgrade

TO PERFORM A SYSTEM SOFTWARE UPGRADE:

1. Insert the system software installation disk into the recorder's Zip drive.
2. Press the SYS hotkey and select the SYSTEM SETUP softkey.
3. Press SYSTEM UPGRADE. The lower text area will display the software version.
4. When prompted to Verify…Are you sure?, press YES to perform the upgrade.
5. Press any key on the front panel to re-boot the system with the new system software.

Glossary

ADC ..... Analog to Digital Converter.

AMP hotkeys ..... These eight keys provide quick access to channel information and allow fast modification of amplifier settings.

amplification ..... Accept an input signal and produce an output signal that is greater than the input.

ARM hotkey ..... A pre-programmed hotkey provided to allow quick manual arming of the system.

attenuation ..... Decrease in signal magnitude.

attenuator ..... Limits the maximum input and sensitivity of the amplifier (zero suppression), the range (full scale span), and available offset.

autobalance ..... Adds a factor to the bridge input level so the result is zero.

calibration ..... Adjusts offset and corrects gain while in a particular attenuation stage for input channels. For bridge input types, bridge imbalance is compensated for. For thermocouple input types, ambient temperature reference is corrected.

channel ID numbers ..... Quickly identify each waveform channel on the chart. Especially useful when waveforms overlap.

Chart Info report ..... Provides a summary of settings for each chart: grid size/position/status, major divisions, minors/majors, pen lift (up/down), event marker position, text buffer (in mm).

Dash 16u ..... A portable recording system that combines the features of a high-speed oscilloscope, a real-time chart recorder, and a multi-channel data acquisition system.

data capture ..... Data capture is the acquisition and storage of real-time waveform data as a result of either a command or the occurrence of an initiating trigger. Captured event data can be played back or analyzed at any time.

data log ..... Numerical printout of waveform data in user-specified engineering units.

demodulation ..... A modulation process wherein a wave resulting from previous modulation is employed to derive a wave having substantially the same characteristics of the original modulating wave.

differential voltage ..... This input type is used to record differential voltages applied between the LIN+ and LIN- pins. This input is isolated from chassis common and other channel inputs. Channel settings are specified in millivolts but can be specified in user engineering units if this feature is active.

DSP circuit ..... Digital Signal Processing circuit.

dual speed ..... Automatic change of recording speed initiated by a trigger.

encoder wheel..... Saves time when making menu selections; when a menu item on the display is highlighted, options related to the item are present in the lower text area of the display and can be modified by turning the wheel.

event markers ..... Markers are recorded in real-time and captured as a group when performing data acquisition.

fast fourier transform ..... (FFT) converts data information in the time domain to the frequency domain; is a convenient tool for determining various frequency components in a time series waveform for any single channel.

FEED hotkey..... Causes the chart paper to advance when pressed, to stop when the key is released.

Gain ..... Sets the channel's active voltage range. The gain of a circuit is the measureable increase in signal level from input to output. Calculated as the ratio of the circuit's output signal level to the input signal level.

HELP hotkey..... Provides basic operational information and information regarding recorder settings in the form of the System Status report and Chart Information report.

hotkeys ..... see AMP, ARM, FEED, HELP, ID, MARK, MODE, SPD, SYS, and TRIG.

ID hotkey..... Pressing the front-panel [ID] key will cause the recorder to print the channel number on each waveform.

leakage ..... Seen as energy leaking out of one of the resolution lines of an FFT into all other lines. One way to reduce leakage due to discontinuities at the window edges is to use a modified window that does not have abrupt edges. This is achieved by multiplying the raw signal by a window function.

LEDs..... Provide visual confirmation of unit arming or triggering provided on the front panel of the unit.

lower text area..... Located on the display screen. Contains fields related to menu selections.

MARK hotkey..... Causes the system mark at the top of the chart to activate in the manner setup by its event style; can be used to mark the start or end at some particular change in a test.

MODE hotkey..... Provides quick access to data input/output, recording, review, offline analysis, archiving, and export functions.

multiple acquisitions ..... (multi-stacking) Automatic system arming and data acquisition with automatic playback and stacking of the resulting records to system memory. Real-time recording is aborted during playback and the record is retained in the inventory of records in system memory.

normal battery mode ..... Enables orderly shutdown in the event of power interruption/loss.

normal display speed.....When the DISPLAY SPEED command is set to NORMAL, the display will run at the fastest possible display speed, regardless of chart speed; selecting NORMAL breaks the connection between the data shown on the display and that presented on the printed chart and causes each display to be refreshed at its maximum rate.

offset .....The center reading of the Range span; the center point of the grid; can be specified by turning the encoder wheel or making entries through the alphanumeric keypad; available choices are limited by the attenuator settings; offset parameter combines zero suppression and baseline offset into a single adjustment.

operational hotkeys .....Cause related menus to appear when pressed and provide instant access to controls and status information.

quick battery mode .....Allows user shutdown by disconnecting the external power source.

range .....The quantity of units from edge to edge of the waveform; range determines the measurement span at full scale. Can be specified by turning the encoder wheel or making entries through the alphanumeric keypad. Numeric entry for range has greater resolution than offered through the wheel options. Available choices for range are determined by the attenuator settings.

rectification .....Process by which electrical energy is transferred from an AC circuit to a DC circuit.

RUN/HALT hotkey.....Advances or halts the chart paper when pressed.

single acquisition.....(single data capture): Single acquisitions are individually added to the inventory of records in system memory. OR (single data capture and playback): Captured data record is played out automatically after capture completes. Real-time recording is aborted during playback and the record is retained in the inventory of records in system memory.

single-ended voltage .....This input type is used to record voltages applied between the VIN_ and COM pins; input is single-ended, but isolated from chassis common and other channel inputs. Channel settings are generally specified in volts but can be specified in user engineering units if this feature is active.

softkeys.....Fast access to menus and submenus on the display.

SPD hotkeys .....Provide quick access to the Set Speed menu; pre-programmed chart recording speed keys are provided for making quick and convenient adjustments to chart and data log speed.

SYS hotkey .....Provides access to the System Setup menu and related functions.

system mark.....A single mark printed at fixed position on the top of chart representative of front panel button input only; the system mark is primarily used for real-time recording, but if required to be captured, a System Mark can be stored on event marker 1 of the event group and reviewed similarly; a System Mark is combined into event #1 and thus event #1 will indicate any activity on either line, although typical use is from the rear panel only.

System Status report..... Provides setting information (amplifier, general recorder, and trigger), and summary information (waveform trigger, data capture and review).

thermocouple ..... Input type used to record the output of single-ended thermocouple probes. The thermocouple is applied between the LIN+ and LIN- pins. This input is isolated from chassis common and other channel inputs.

timed recording ..... Toggles between two different chart speeds continuously and automatically after operating at each speed for a specified time.

trend display speed ..... When the DISPLAY SPEED command is set to TREND, the waveform data presented on the display approximates the speed and appearance of the printed chart.

TRIG hotkey..... Pre-programmed hotkey provided for quick manual triggering of the system.

triggered recording..... Toggles two different chart speeds continuously and automatically each time a trigger is used.

upper text area..... Text related to menu items.

user engineering units .... All signal information enters the recorder as electrical voltage. Set the recorder to display in UEUs to convert and display voltage in numerical values applicable to the measurement being taken (i.e. pressure, temperature, etc.)

user scaling..... A scaling value used to convert voltage values into user-defined engineering units.

waveform display area ... Area of the monitor where waveforms and grids are displayed.

window leakage..... See leakage.

zero suppression..... Setting maximum input and sensitivity of the amplifier.

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